Environment Canada Environnement Canada

Technical Guidelines for the *Environmental Emergency Regulations*

Version 2.0

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Canada

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Disclaimer

This version of the Technical Guidelines for the *Environmental Emergency Regulations, 2019* was published in October 2020. Amendments to the previous version are summarized in the table below.

It is the user's responsibility to ensure that they are using the most up to date version of this document. This can be verified from the Environmental Emergencies website at:

https://www.canada.ca/en/environment-climate-change/services/environmental-emergencies-program/regulations.html under the heading entitled "Related Information".

This material has been prepared for convenience of reference and accessibility and does not have an official character. For all purposes of interpreting and applying the Regulations, users must consult the official version of the *Environmental Emergency Regulations, 2019* and seek their own legal advice as appropriate. The user of this document is solely responsible for any legal liability for the consequence of its use or misuse

Revision History* (January 2020 – July 2020)

Revision Number	Section	Page	Comments
1	Glossary	6	The term "Alternative scenario" has been removed
2	Glossary	6	The term "Alternate Scenario" has been added
3	Glossary	6	The term "Alternate Worst-case Scenario" has been added
4	Glossary	6	The definition of "Container System" has been modified.
5	Glossary	6	The term "E2 substance" has been added
6	Glossary	7	The definition of "Environmental emergency" has been modified
7	Glossary	7	The definition of "facility" has been modified
8	Glossary	7	The term "Maximum Expected Quantity" has been added
9	Glossary	7	The definition of "Mixture" has been modified
10	Glossary	8	A definition of "Person" has been added
11	Glossary	8	The definition of "regulatee" has been modified
12	Glossary	8	The definition of "responsible person" has been modified
13	Glossary	8	A definition for "reasonable" has been added
14	Glossary	8	The definition of "Simulation Exercise" has been modified

15	Glossary	8	The definition of "worst-case scenario" has been modified to more closely reflect the Regulations. It no longer includes the word reasonable.
16	Section 1.0	9	The abbreviation for The Technical Guidelines for the Environmental Emergency Regulations, 2019 has been changed from the E2 Technical Guidelines 2019 to "the Guidelines".
17	Section 1.0	9	Has been reworded and updated to reflect newly added appendices
18	Section 1.0	9	The disclaimer has been modified to include other stakeholders.
19	Section 2.0	11	Has been reworded
20	Section 4.0	13	Has been reworded to provide additional clarity
21	Section 4.0	14	The flowchart to help determine if a facility is regulated has been slightly modified
22	Section 4.1.3	17	Section on protecting confidential information has been updated
23	Section 4.1.4	18	Has been updated to reflect some of the logistics of the E2 Online Reporting System
24	Section 4.1.4	22	Has been updated to provide guidance on the reporting of environmental emergencies at unregistered facilities
25	Section 5.0	23	Has been updated to provide additional clarity on the preparation of E2 Plans. Significant changes were made. Information on exercising E2 Plans is now in a separate section
26	Section 5.0	24	Clarification has been provided on regulatory requirements vs recommendations based on Best Practices
27	Section 5.1	24	Approach to developing an E2 plan has been reworded
28	Section 5.2	25	Section on adequate measures has been added
29	Section 5.3	25	E2 Plan Content has been added. This includes hazard identification, risk assessment and plan development.
30	Section 5.3.5.2	36	Section on Hazard Analysis for the identification of environmental emergency scenarios has been added.
31	Section 5.3.5.3	37	Section on Environmental Emergency Scenario Identification has been added. It includes: the use of active and passive mitigation measures, identification of worst-case and alternate worst-case scenarios, and the evaluation of domino effects, knock-on effects, leasing agreements, and natural disasters.
32	Section 5.4.4.	65	Additional guidance on the requirements for the annual review of the E2 Plan has been provided
33	Section 6.0	67	Has been created to provide guidance on exercising E2 Plans. Significant changes were made and examples of exercise schedules are now available
34	Section 6.4	73	A section on Frequently Asked Questions respecting exercising E2 Plans has been added
35	Section 7.0	76	Notification of environmental emergencies is now in Section 7
36	Section 7.0	76	Has been reworded to provide additional guidance on the reporting of environmental emergencies. Significant changes were made, including the addition of a flowchart
37	Appendices	N/A	Have been re-ordered to accommodate the inclusion of new material:
38	Appendix 1	85	Now contains Regional Contact Information
39	Appendix 2	89	Guidance on dealing with mixtures has been added
40	Appendix 3	97	The former appendix 3 (Determination of Container Capacity and Substance Quantity) has been divided into two sections. This appendix contains guidance on valves and container system Significant new content has been added
41	Appendix 4	105	Now contains examples of calculations to determine quantity of a substance onsite. Example 7b has been added to demonstrate normalization of percentage ranges in mixtures. Examples 6, 7a, and 9

			have been modified to reflect that the substances are identified in Part 1 of Schedule 2 and not Part 2.
42	Appendix 5	143	The appendix on exclusions has been expanded to provide guidance on all exclusions, and specific examples for the heating and power generation exclusion for fuels
43	Appendix 6	154	Additional references have been added
44	Appendix 7	159	The checklist for the preparation of an E2 Plan has been updated
45	Appendix 8	176	An example of a table of contents for an E2 Plan has been added
46	Appendix 9	180	Suggested endpoints for flammable vapour concentration have been added. References for environmental indicators/risk assessment have been added.

*Previous version – Published December 2019

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Glossary

Alternate scenario	Means an environmental emergency scenario that could reasonably be expected to occur at a facility and that would likely cause harm to the environment or constitute a danger to human life or health.
Alternate worst-case scenario	Means the scenario described in section 4(2)(f) of the E2 Regulations. It involves the alternate scenario that is more likely to occur than the worst-case scenario ***and*** that has the longest impact distance outside the boundary of the facility (if it exists).
CAS registry number	Means the identification number assigned to a substance by the Chemical Abstracts Service, a division of the American Chemical Society.
CEPA 1999	Means the *Canadian Environmental Protection Act, 1999*.
Container system	Means any receptacle or network of receptacles that is used to contain a substance—including any connected pipelines or piping—except any part of that network that is automatically or remotely segregated from the rest of the network by shut-off valves, or other mechanisms, in the event of any environmental emergency. When several smaller containers are stacked in a larger container, then the smallest container should be considered the container size for the substance in question. Additional information on container systems and valves can be found in Appendix 3 of these Guidelines
E2	Environmental emergency
E2 substance	Means a substance, either in its pure form or as a component of a mixture, that: • Is identified by a CAS# in Schedule 1 of the E2 Regulations; • Meets or exceeds the concentration threshold in column 4 of Schedule 1 of the E2 Regulations; and

	• Does not meet any of the exclusion criteria in Section 2(2) of the E2 Regulations
ECCC	Environment and Climate Change Canada
Environmental emergency	Means an uncontrolled, unplanned or accidental release of an E2 substance into the environment (or the reasonable likelihood of such a release) that: a) Has or may have an immediate or long term harmful effect on the environment; b) Constitutes or may constitute a danger to the environment on which human life depends; or c) Constitutes or may constitute a danger in Canada to human life or health.
Facility	Means a property on which one or more fixed onshore installations are located and where an E2 substance is present.
Full-scale simulation exercise	Means an action-based simulation exercise requiring the deployment of personnel, resources and equipment.
Maximum capacity	Means, in respect of a container system, its full physical capacity, expressed in tonnes, including any capacity that is beyond the safe-fill limit set by the manufacturer of the receptacles that compromise the container system.
Maximum Expected Quantity	Means a calculation of the amount of a substance, both contained and uncontained, that is expected to be at a facility (stored or processed) during a calendar year, beginning on the day the on which the quantity threshold for that substance is met or exceeded. This includes quantities of both the pure form of the substance and any quantities found in mixtures that contain the substance. Given that exact amounts would likely not be known in advance, this would be an estimate or forecast.
Mixture	Means a combination of two or more substances where the substances retain their individual chemical properties and no reaction between them occurs. For the purposes of the E2 Regulations, a mixture can include one or more E2 substances.

Person	May refer to a company, an individual or a government body
PID	Piping and Instrumentation Diagram.
Reasonable	Means logically valid. It is based on using sound judgment, and therefore, practical, and sensible; as opposed to extreme or excessive. It is not dependent on frequency of occurrence
Regulatee	Means a facility that is subject to the requirements of the E2 Regulations.
E2 Regulations	Means the *Environmental Emergency Regulations, 2019.*
Responsible person	Means any person who owns or has the charge, management or control of an E2 substance that is located at a facility. The term "person" may refer to a company, an individual or a government body
SDS	Safety Data Sheet
Simulation exercise	Means an exercise simulating the response to an environmental emergency involving the release of an E2 substance.
Worst–case scenario	Means the scenario described in section 4(2)(e) of the E2 Regulations. It must involve the release of the maximum quantity of an E2 substance that could be contained in the container system with the largest maximum capacity at a facility, or the maximum expected quantity of the substance on-site that is not contained. It need not be reasonable.

1.0 Purpose of the Technical Guidelines

The Technical Guidelines for the *Environmental Emergency Regulations, 2019* (the Guidelines) are intended for the use of any person who owns or has the charge, management or control of a substance listed in Schedule 1 of the *Environmental Emergency Regulations, 2019* (the E2 Regulations).

These Guidelines are designed to help regulatees better understand the E2 Regulations and ensure that their facilities are compliant with its requirements. The document will provide clarification and guidance on questions such as the following.

- Do the E2 Regulations apply to me?
- How do I calculate on-site substance quantities and container system capacity?
- How do I provide notification that I have the charge, management or control of an E2 substance?
- Do I need to prepare an E2 Plan?
- How do I prepare an E2 Plan? What should it include?
- What is involved in exercising my E2 Plan?
- What other reports are required under the E2 Regulations?
- What happens if I fail to comply with the E2 Regulations?

Other helpful information is provided in tables, figures and references, located mostly in the appendices below:

Appendix 1 – Regional contact information for the E2 Regulations
Appendix 2 – Dealing with Mixtures under the E2 Regulations
Appendix 3 – Container Systems and Valves
Appendix 4 – Determination of Quantity of a Substance Onsite
Appendix 5 – Additional Guidance on Exclusions
Appendix 6 – Suggested references for environmental emergencies prevention, preparedness and response measures and the development of E2 Plans
Appendix 7 – Checklist to prepare an E2 plan
Appendix 8 – Suggested Table of Contents for an E2 Plan
Appendix 9 – Suggested Endpoints for the E2 Regulations

For assistance regarding the E2 Regulations, please contact your regional representative. Contact details can be found in Appendix 1.

IMPORTANT: The Technical Guidelines for the *Environmental Emergency Regulations, 2019* are intended to provide contextual information on the E2 Regulations and the *Canadian Environmental Protection Act, 1999* (CEPA 1999.). They do not replace CEPA

1999 or the E2 Regulations. Regulatees and other stakeholders should refer to CEPA 1999 at http://laws-lois.justice.gc.ca/eng/acts/C-15.31/ and the E2 Regulations at canada.ca/environmental-emergency-regulations to ensure compliance with the legislation.

Provisions of CEPA 1999 and the E2 Regulations have been quoted for convenience or reference only, and have no official sanction. Should any inconsistencies be found between the Technical Guidelines for the *Environmental Emergency Regulations, 2019* and CEPA 1999 or the E2 Regulations, then CEPA 1999 and the E2 Regulations will prevail.

2.0 Environmental Emergency Authorities under Part 8 of CEPA 1999

This section of the Guidelines provides information on the authorities granted under CEPA 1999, and under the E2 Regulations themselves.

As stated in the Preamble to CEPA 1999, the goal of the Government of Canada is to achieve "the highest level of environmental quality for all Canadians". Paragraph 2(1)(a.1) of the Act also requires the Government of Canada to "take preventive and remedial measures to protect, enhance and restore the environment."

Part 8 of CEPA 1999 (sections 193 to 205) provides the authority to:

- address the **prevention** of, **preparedness** for, **response** to and **recovery** from environmental emergencies caused by uncontrolled, unplanned or accidental releases; and
- reduce any foreseeable likelihood of releases of toxic or other hazardous substances listed in Schedule 1 of the E2 Regulations.

The Government of Canada has identified emergency planning as an important tool to increase the safety and security of Canadians in the event of an environmental emergency. Sections 199, 200 and 200.1 of Part 8 of CEPA contain provisions that allow for the establishment of a list of toxic or other hazardous substances, and the requirement for the preparation of environmental emergency plans (E2 plans) and other reports for these substances . The primary objective for requiring environmental emergency planning is to ensure that appropriate management practices are adopted and implemented to reduce the potential risks associated with the manufacture, storage and use of these substances in Canada.

Schedule 1 of the E2 Regulations contains lists of substances (Part 1) and solutions (Part 2) that, should they be accidentally released, have the potential to be harmful to the environment, its biological diversity, and / or human life or health. Minimum quantities and concentrations have been established for these substances, at or above which the Minister may require notice of identification of the substance and place, as well as preparation and implementation of E2 Plans under the E2 Regulations.

There are strict penalties for failing to comply with the provisions of CEPA 1999 and its regulations. Sections 272 to 274 of CEPA, (Part 10 - Enforcement) outline various offences and penalties for: contraventions of the legislation, knowingly or negligently providing false or misleading information, causing intentional or reckless damage to the environment, and showing wanton or reckless disregard for the lives or safety of other persons and leading to the risk of death or harm to persons.

3.0 Benefits of E2 Planning

Environmental emergency planning is not just about compliance with the E2 Regulations. For today's modern enterprise, effective planning for emergency events is an essential part of good business management.

When E2 planning is properly developed and brought into effect, benefits to the environment, human health and industry ensue. An industry-wide study conducted by the Center for Chemical Process Safety of the American Institute of Chemical Engineers confirms that E2 planning provides measurable benefits by:

- **Saving lives and reducing human injury**;
- **Reducing property damage costs**, preventing the sometimes extreme costs of a major industrial incident;
- **Shortening business interruptions**, which can be four times as costly as the property damage mentioned above;
- **Lessening loss of market share**, which continues after an incident until the company's production and reputation are restored;
- **Lowering litigation costs**, which are unavoidable after an incident and can total five times the cost of the regulatory fines;
- **Reducing incident investigation costs**, as well as corrective actions, which can cost millions of dollars; and
- **Reducing regulatory penalties**.

E2 planning also provides non-measurable benefits by:

- Greatly **reducing the risk of catastrophic events**, resulting in less severe incidents, which:
    - **engages employees** at all levels by increasing morale, loyalty and retention;
    - **reduces concerns within the local community**;
    - **helps regulators understand your facility's credibility and unique considerations**;
- **Improving your corporate image;** and
- **Enhancing your lenders' confidence**, thus promoting capital expansion.

An important step in E2 planning is the analysis of all kinds of risks found during the handling, storage, production process, use or disposal of any hazardous substances. When the proper measures to eliminate or mitigate these risks are implemented, other benefits follow:

- **Productivity increases while production and maintenance costs decrease**, due to the correction of unproductive processes and the adherence to effective and well-timed maintenance procedures.
- **Lower insurance premiums** may be obtained when meticulous emergency planning is implemented to prevent minor incidents and greatly reduce major incidents.

4.0 Am I Regulated?

This section of the Guidelines is designed to assist in the determination of whether or not the E2 Regulations apply to a facility, and identify any obligations that must be met. The quick reference diagram (Figure 1) on the following page should be used in conjunction with the questions outlined in Table 1 below.

The process applies to both mixtures and pure substances. Additional information on dealing with mixtures can be found in Appendix 2 of this document.

Please note the following before proceeding:

1. An up to date Safety Data Sheet (SDS) for the substance(s) may be required for this exercise.

2. The concentration of the substance is required in order to start the process. If it is not known, the upper range of the concentration by weight that is listed on the SDS for the substance, or any other accurate source of the information, can be used for the assessment in Step 2 of Figure 1.

3. The process may require the calculation of the maximum capacity of the ***container system*** in which the substance is stored. Additional information on container systems and the calculation of their capacities can be found in Appendix 3 of this document.

4. The maximum expected quantity of a substance onsite may have to be determined. Sample calculations can be found in Appendix 4 of this document. If the substance is in a mixture, and its concentration is not known, the upper range listed by weight on the SDS will be considered the proportion of the regulated substance within the mixture. Under these circumstances, the percentages for each component in the mixture may have to be normalized. (Note that the normalized percentage is ***not*** to be used in Step 2 of Figure 1.) A sample calculation can be found in examples 7b and 9 in Appendix 4. Alternatively, a facility may choose to run an analysis to determine the exact concentration of any E2 substances in the mixture.

5. The notices listed as being required for submission in Figure 1 are not exhaustive. Facilities subject to the E2 Regulations may also be required to submit other notices for a variety of reasons. These notices, along with their submission timelines, are summarized in section 4.1.2 of this document.

Table 1. Determination of If/How the E2 Regulations Apply to a Facility

	Question	Yes	No
1	Does the substance have a CAS #?	Proceed to Question 2.	Assign an applicable CAS# (if possible) and proceed to Question 2, **OR** proceed to Question 3.
2	Is the substance's CAS# listed in column 1 of Schedule 1 of the E2 Regulations?	Proceed to Step 2 in Figure 1 on the following page.	Proceed to Question 3.
3	Does the substance contain one or more constituents identified by a CAS# in column 1 and/or a name in column 2 of Schedule 1 of the E2 Regulations? (this information should be listed in the SDS)	For each of those constituents, proceed to Step 2 in Figure 1 on the following page. (For example, if the substance contains benzene and kerosene, the kerosene is not subject to the E2 Regulations, but the benzene component must be assessed.)	The substance is not subject to the E2 Regulations.

Figure 1. Environmental Emergency Regulations, 2019 – Quick Reference

Yes

STEP 1: Is the substance identified by a CAS# listed in column 1 of Schedule 1 of the Regulations? *Section 2 of the Regulations*

Yes

STEP 2: Does the substance have a concentration (by weight) ≥ its threshold concentration (Schedule 1, column 3)?

NO

Substance is not Subject to the Regulations

STEP 3: Do any of the following substance exclusions apply? *

- A substance identified in column 5 of Part 1 of Schedule 1 as combustible (C) or likely to explode (E) and
  - is in a mixture that has a flashpoint >23°C and a boiling point >35°C, or
  - is a component of natural gas in its gaseous form.
- A substance identified in column 5 of Schedule 1 as an inhalation hazard (I) and is in a mixture, in gaseous or liquid form, that has a total vapour pressure < 1.33 kPa.
- A substance used to fuel a heating appliance or generate power at the facility where it is located and is present in a total quantity at the site < the quantity in column 4 of Part 1 of Schedule 1 for that substance.
- A substance regulated under the *Transportation of Dangerous Goods Act, 1992,* or the *Canada Shipping Act, 2001*.A substance in a pipeline regulated under the *National Energy Board Onshore Pipeline Regulations* or in a processing plant under the *National Energy Board Processing Plant Regulations.*
- A substance in a pipeline located entirely within a province on a property where there are no fixed onshore installations other than pipelines, compressor stations or pump stations.
- A substance that is in a fuel tank that is connected to and supplies an engine of conveyance used for transportation.
- Naphthalene in solid form.
- Nickel oxide in the form of solid particles > 10 µm.
- Phosphorus in a form other than white phosphorus.

*additional explanation of these exclusions can be found in Appendix 5

Subsection 2(2) of the Regulations

YES

NO

STEP 4: Is the maximum expected quantity of the substance OR the capacity of the largest container system for the substance ≥ the threshold quantity identified in column 4 of Schedule 1 in the Regulations *after* the following quantity exclusions* are taken into account? All quantities located at a facility must be included, except the following:

- Substance stored at a facility for 72 hours or less unless it is loaded or unloaded at the facility;
- Quantity in small containers (30 kg or less);
- Quantities found in slag, waste rock, tailings, solid residues, ores and ore concentrates;
- Propane in a container system with a maximum capacity of less than 10 t and the container system is located ≥ 360 m from all points along the boundary of the facility; and
- Anhydrous ammonia or ammonia solution used on-site as an agricultural nutrient in farming operations.

*additional explanation of these exclusions can be found in Appendix 5

Subsection 3(2) of the Regulations

YES

NO

STEP 5: Submit Notice Regarding Substances Located at a Facility (Schedule 2) within 90 days after the later of i) the day on which the Regulations come into force (Aug 24, 2019) or ii) the day the total quantity at the facility or the maximum capacity of the largest container is ≥ the threshold value. (see page 18)
Subsection 3(1) of the Regulations

The substance is subject to reporting requirements under Section 18 of the Regulations if it is accidentally released:

- Provide a verbal notification (see Chapter 7);
- Take all reasonable measures to prevent, repair, reduce or mitigate negative effects on humans and the environment;
- Make a reasonable effort to notify the public who may be affected; and
- Provide a written report containing information in Schedule 8, if necessary (see Chapter 7).

STEP 6: Is some or all of the substance not in a container system and does the total quantity meet or exceed the threshold amount?
OR
Are both the total quantity at the facility AND the maximum capacity of the largest container system for the substance ≥ the threshold amount?
Subsection 4(1) of the Regulations

NO

YES

STEP 7: Submit Notice Regarding the Preparation of an Environmental Emergency Plan (Schedule 3) within 6 months after the day on which an E2 Plan is required. (see page *19)*
Section 5 of the Regulations

STEP 8: Submit Notice Regarding the Bringing into Effect of an Environmental Emergency Plan (Schedule 4) within 12 months after the day on which an E2 Plan is required. (see page 19)
Section 6 of the Regulations

STEP 9: Annual Exercise and E2 Plan Review: Update and test the plan at least once a year based on a simulation exercise that uses at least one substance from each of the hazard categories that are applicable at the facility. Every year, a different exercise must be simulated with respect to any substance within a hazard category until all the environmental emergencies that have been identified in the plan for the substance(s) have been exercised. Once all exercises have been simulated, they must be cycled through again. Keep records of annual exercises and E2 Plan revisions from the previous 7 years so they can be inspected upon request. (see chapter 6

Paragraph 7(1)(a), Subsection 7(2), and Sections 8 and 10 of the Regulations

STEP 10: Conduct full-scale simulation exercise and Submit Notice Regarding Simulation Exercises Conducted in Relation to an Environmental Emergency Plan (Schedule 5) within 5 years after the day on which the E2 Plan is brought into effect. (see page 20)
Paragraph 7(1)(b) and Section 9 of the Regulations

4.1 The E2 Regulations - Reporting Requirements

A facility may be subject to a number of reporting requirements under the E2 Regulations. This section is designed to help identify these requirements and describe the timelines and methods for their submission.

Do you own a Facility that has E2 Substances Onsite but is not required to Submit the Notice Identified in Schedule 2 of the Regulations?

If the concentration of the substance meets or exceeds the concentration in column 3 of Schedule 1 in the Regulations, you will still be required to report any accidental releases from your facility if they result in an environmental emergency. Please refer to Chapter 7 for more detailed information.

4.1.1 Reporting to ECCC

The E2 Regulations stipulate that any required information be provided to ECCC through a Notice of Submission or written report. Many of these notices were identified in the quick reference diagram on the previous page. The information to be included in each notice or report is identified in Schedules 2 through 8 of the E2 Regulations. This information allows the Department to fulfil its mandate by keeping a record of potential risks to the environment and human health within Canada as identified in CEPA 1999.

Do you own several facilities?

You must submit separate notices and keep separate records for each facility.

4.1.2 What and when do I need to report to ECCC?

The following table provides a list of all of the Notices of Submission and the written report that may need to be provided to ECCC, along with the associated Schedule in the E2 Regulations that identifies the required information, and the legislated timelines for their submission. The thresholds referred to in the table can be found in column 4 of Schedule 1 of the E2 Regulations. More detailed information on the contents of the Notices and written report and their online submission can be found in Section 4.1.4 of this document.

Table 2. Requirements for the Submission of Notices and Reports to ECCC

Schedule	Title of Notice / Report	Timeline for Submission
Schedule 2	Notice Regarding Substance Located at Facility	Within 90 days of meeting or exceeding the substance quantity or container capacity threshold, and every 5 years thereafter.
		If applicable, within 60 days after the reported company information has changed *or* either of the maximum expected quantity or maximum capacity has increased by 10% or more
Schedule 3	Notice Regarding the Preparation of an Environmental Emergency Plan	Within 6 months of meeting or exceeding both the substance quantity and container capacity thresholds *or* only the quantity threshold for a substance that is not held in a container system
Schedule 4	Notice Regarding the Bringing into Effect of an Environmental Emergency Plan	Within 12 months of meeting or exceeding both the substance quantity and container capacity thresholds *or* only the quantity threshold for a substance that is not in a container system
Schedule 5	Notice Regarding Simulation Exercises Conducted in Relation to an Environmental Emergency Plan	Within 5 years after the day on which the E2 plan is brought into effect, and every 5 years thereafter
Schedule 6	Notice Regarding a Change in Quantity or Capacity	Within 60 days after the end of a 12-month period during which the threshold is no longer met
Schedule 7	Notice of Cessation of Operation	Within 30 days before the day on which the operations are to cease, or as soon as feasible in the case of extraordinary circumstances (e.g., a sudden plant shut-down).
	or Transfer of Operation	On or before the date of transfer
Schedule 8	Information to Be Included in the Written Report of Environmental Emergency*	As soon as reasonably possible in the case of 1. an environmental emergency involving the release of a hazardous substance that a. has or may have an immediate or long-term harmful effect on the environment, or b. constitutes or may constitute a danger to the environment on which human life depends, or c. constitutes or may constitute a danger in Canada to human life or health 2. The reasonable likelihood of an occurrence of an environmental emergency

* Note, verbal reports of accidental releases are also required to be submitted to ECCC as soon as reasonably possible.

4.1.3 How to report to ECCC

All schedules must be submitted through the E2 Online Reporting System which is accessed through ECCC's Single Window Information Management (SWIM) system. The E2 Online Reporting System represents a modern and convenient way to submit and update information related to regulated facilities, hazardous substances, and environmental emergency planning. It sends email reminders to registered users to inform them of upcoming deadlines for the submission of information; and acts as a mechanism for the submission of electronic written reports when an environmental emergency occurs.

In order to use the system, a facility must have a sign in partner or obtain a GCKey. They may then be required to obtain permission for the E2 Regulations application. This process could take several days.

Detailed step-by-step guidance on how to navigate SWIM and operate the E2 Online Reporting System can be found at: https://www.canada.ca/en/environment-climate-change/services/environmental-emergencies-program/regulations/filing-notice.html. Regional offices may also be contacted for assistance at: ec.ue_gigue2_swim.ec@canada.ca

A facility that has E2 substances onsite, but that is not required to register in the E2 Online Reporting System may submit a written report regarding an environmental emergency through the following public link: https://pollution-waste.canada.ca/spill-reporting.

Protecting Confidential Information

Environment and Climate Change Canada is committed to upholding its obligations with respect to confidentiality in accordance with the *Access to Information Act* and *Privacy Act.* Therefore, the information submitted by a regulatee will be kept confidential to the extent permitted under the Acts.

Information collected under the *E2 Regulations, 2019* may be released to public safety authorities and, under limited circumstances, to other federal departments, and levels of government in Canada. Additionally, facility names and location(s) (city) may be made available to the public, if required, through the open data government portal.

A regulatee requiring additional protection of their information may submit a written request to the Minister under section 313 of the Canadian Environmental Protection Act 1999. For more information, please visit the *Access to Information Act*, *Privacy Act,* and the *Canadian Environmental Protection Act* websites."

4.1.4 Description and Reports

A description of the various types of notices and reports that a regulatee might be required to submit to ECCC is provided below.

Schedule 2: Notice Regarding Substances Located at a Facility

This notice is required to provide basic information regarding a facility that has regulated substances onsite. It includes: the name and location of the facility, the number of people onsite, contact information, the concentration and maximum expected quantity of any E2 substances onsite, and, if applicable, the capacity of the largest container system in which the substance resides.

Please note that the term maximum expected quantity is an ***estimate*** of the maximum quantity of a substance, both contained and uncontained, that will be onsite during the calendar year in all storage places and processes, including pipes. The word "expected" implies an estimate or forecast; therefore, the amount needs to be reported within 90 days from the time a threshold is ***expected*** to be reached or exceeded, not at the point when actual quantities are known.

The effective date on this notice determines the due date of many of the other notices required under the E2 Regulations. Once this notice has been submitted online, the date(s) cannot be modified by the user. Therefore, care should be taken to ensure that the effective date is accurately entered. The required dates for submission are as follows:

- August 24, 2019 if a facility was captured by the previous version of the Environmental Emergency Regulations; or
- The date on which the total maximum expected quantity of the substance reached or exceeded the threshold; and/or
- The date on which the maximum capacity of the largest container system reached or exceeded the threshold.

The responsible person is required to confirm (or edit, if necessary) the information contained in their facility's Schedule 2 at least once every five years, even if there is no need to edit any information. It will also need to be edited and resubmitted within 60 days of:

- Any changes to the facility information;
- Any changes to the maximum expected quantity of a substance; or
- An increase of 10% or more in the capacity of the largest container system.

Editing the required information in the Schedule 2 Notice is accomplished by locating the Schedule 2 on the dashboard of the E2 Online Reporting System and using the "Edit" function (pencil icon). The user should be sure to select the most appropriate reasons for the edit on the drop down list as it may affect the system and the deadlines. Options

include Year 5 Review and Amendment.

Schedule 3: Notice Regarding the Preparation of an Environmental Emergency Plan

The submission of the Notice Regarding the Preparation of an Environmental Emergency Plan informs ECCC that the facility has finished developing their E2 Plan. It includes details such as: the nature of the facility's operations, the contribution of local authorities and the local community to the development of the plan, the date the plan was prepared, the predicted impact distances of both the worst-case scenario and alternate worst-case scenario, and, if applicable, a description of the area around the facility that may be impacted by the alternate worst-case scenario. Please note that the E2 Plan itself is not included in the submission, but must be kept readily available onsite.

A blank Schedule 3 submission page should be generated in the E2 Online Reporting System, and automatically added to a facility's dashboard if the system determines that it is necessary based on the responses in the Schedule 2 submission. If that does not occur, it can also be added manually by the user.

Please note that the information displayed on the Facility Information page of the Schedule 3 notice is ***pre-populated based on the information in the Schedule 2 notice*** and cannot be modified. If this information needs to be changed, the Schedule 2 notice must be edited and then re-submitted. Once the Schedule 3 notice has been submitted, it can still be edited by the user to:

- Add missing information for substances;
- Add information for substances that now require an E2 Plan; and
- Modify information contained in the E2 Plans.

Schedule 4: Notice Regarding the Bringing Into Effect of an Environmental Emergency Plan

This notice provides ECCC with the date on which an E2 Plan is complete and ready to be implemented in the event of an environmental emergency at the facility. After a Schedule 3 notice has been submitted in the E2 Online Reporting System, a blank Schedule 4 submission page should be created automatically and added to a facility's dashboard. If this does not occur, it can also be manually added by the user.

Please note that the information displayed on the Facility Information page of the Schedule 4 notice is ***pre-populated based on the information in the Schedule 2 notice*** and cannot be modified. If this information needs to be changed, the Schedule 2 notice must be edited and then re-submitted. Once the Schedule 4 notice has been submitted, it can still be edited by the user to:

- Add missing information for substances;
- Add information for substances that now require an E2 Plan; and
- Edit information regarding the bringing into effect of E2 Plans.

The E2 Plan must be reviewed annually, at minimum, and updated as required. Any changes to the E2 Plan which affects information that has previously been submitted through the online reporting system, (e.g., change in facility information, new substance(s), change to impact distances, etc.), would require the editing and resubmission of the associated notice(s).

Although the E2 Plan is not submitted with the Notice, it needs to be readily available for consultation by individuals who are required to carry it out, and to be viewed upon request by Enforcement Officers.

Schedule 5: Notice Regarding Simulation Exercises Conducted in Relation to an Environmental Emergency Plan

The submission of this notice provides confirmation to ECCC that the annual simulation exercises for the E2 Plan have been conducted. As part of this submission, the regulatee is also required to provide details regarding the full scale exercise, including a list of any local responders and community groups involved, and the whether or not the E2 Plan was subsequently updated.

Please note that the E2 Online Reporting System will not allow the creation of the Schedule 5 submission page until after the Notice Regarding the Bringing into Effect of an Environmental Emergency Plan (Schedule 4) has been submitted.

The information displayed on the Facility Information page of the Schedule 5 notice is ***pre-populated based on the information in the Schedule 2 notice*** and cannot be modified. If this information needs to be changed, the Schedule 2 notice must be edited and then re-submitted. Once the Schedule 5 notice has been submitted, it can still be edited by the user to:

- Add missing information for substances;
- Add information for substances that now require an E2 Plan; and
- Modify information concerning the exercises.

Schedule 6: Notice Regarding a Change in Quantity or Capacity

The submission of the Notice Regarding a Change in Quantity or Capacity informs ECCC that the facility has changed its operations such that the maximum expected quantity of a substance, and/or the maximum capacity of the largest container system in which it has stored, has decreased to below specified thresholds. This change must have been in effect for a period of one year or more prior to the submission of the notice.

A Schedule 6 submission page is not created automatically by the E2 Online Reporting

System; it must be added by the user in the dashboard. The system will not allow this to occur until after a Schedule 2 notice has been submitted.

Please note that the information displayed on the Facility Information page of the Schedule 6 notice is ***pre-populated based on the information in the Schedule 2 notice*** and cannot be modified. If this information needs to be changed, the Schedule 2 notice must be edited and then re-submitted. Once submitted, the information in the Schedule 6 notice can be modified at any time.

Please note that E2 Online Reporting System will automatically update the previously submitted Schedule 2 notice to reflect the new information regarding maximum expected quantity and/or maximum capacity of the largest container system contained in the Schedule 6 notice. This will also affect the requirements for the submission of an E2 Plan and the associated exercises, and may remove the need to resubmit the Schedule 2 notice every five years. It is recommended that the user review all of their previously submitted notices in order to fully understand the impact of the associated changes.

Schedule 7: Notice of Cessation of Operations or Transfer of Ownership

Submission of this notice informs ECCC that either the facility will stop its operation for one year or more, for reasons other than maintenance; or that the ownership of the facility has changed. In the latter case, the regulatee is required to provide the date of the transfer, and the name of the new owner.

A Schedule 7 submission is not created automatically by the E2 Online Reporting System; it must be added by the user in the dashboard. The system will not allow this to occur until after a Schedule 2 notice has been submitted.

Please note that the information displayed on the Facility Information page of the Schedule 7 notice is ***pre-populated based on the information in the Schedule 2 notice*** and cannot be modified. If this information needs to be changed, the Schedule 2 notice must be edited and then re-submitted. Once submitted, the information in the Schedule 7 notice can be modified at any time.

The submission of a Schedule 7 notice modifies a facility's information such that it is no longer considered Active in the system. It also causes the E2 Online Reporting System to automatically update and archive any previously submitted Schedules along with the status of the facility. Should a facility wish to change their status to Active in the system at some point in the future, they must make the request through a Regional Compliance Promotion Officer, who can be reached at: ec.ue_gigue2_swim.ec@canada.ca.

Note that if the facility has transferred ownership, the new owners will have to resubmit all applicable notices/reports and the reporting timelines will start over.

Schedule 8: Information to Be Included in the Written Report of Environmental Emergency

The submission a Written Report of Environmental Emergency provides details regarding an environmental emergency involving a chemical that meets the definition of a substance in the E2 Regulations. It must describe the nature of the event, the name and quantity of the substance involved, the state of the container system (if applicable), the impact of the release, and measures taken to prevent a recurrence.

The accidental, uncontrolled, or unauthorized release of a regulated substance must be reported if it meets at least one of the following criteria:

1. Has or may have an immediate or long-term harmful effect on the environment;
2. Constitutes or may constitute a danger to the environment on which human life depends; or
3. Constitutes or may constitute a danger in Canada to human life or health.

Additional information on the regulatory requirements for reporting environmental emergencies can be found in Section 7 of this document.

A Schedule 8 submission is not created automatically by the E2 Online Reporting System; it must be added by the user in the dashboard. The system will allow this to occur as soon as a facility is registered.

Please note that the information displayed on the Facility Information page of the Schedule 8 notice is ***pre-populated based on the information in the Schedule 2 notice*** and cannot be modified. If this information needs to be changed, the Schedule 2 notice must be edited and then re-submitted. Once submitted, the information in the Schedule 8 notice can be modified at any time.

Written reports of environmental emergencies occurring at unregistered facilities can be made at the following public link: https://pollution-waste.canada.ca/spill-reporting.

5.0 Environmental Emergency Plans

The E2 Regulations require facilities that meet or exceed established threshold concentrations and quantities for E2 substances to develop an Environmental Emergency Plan (E2 Plan). The complexity of an E2 Plan may vary depending upon the circumstances, but the following basic factors always need to be taken into consideration:

- The E2 Plan must be site specific. If a regulatee owns several facilities, they must submit separate notices, reports, and E2 Plans for each facility.
- A single E2 Plan may deal with one or more substances as long as it addresses the full range of potential hazards present on the site and the elements of prevention, preparedness, response and recovery for identified E2 scenarios.
- Site specific training and emergency response equipment must be identified in the E2 Plan
- The E2 Plan must contain a process for notification of environmental emergencies with members of the public who may be adversely affected.
- Records of annual simulation exercises and any subsequent updates to the E2 Plan must be kept at the facility.

Who Should Prepare an E2 Plan?

An E2 Plan is required of any person who owns or has the charge, management or control of any of the regulated substances under certain conditions. To see if you are required to prepare, implement and carry out an E2 Plan, refer to Section 4.0 of these Guidelines.

It is important to realize that it is the Notice Regarding the Preparation of an Environmental Emergency Plan (Schedule 3) and the Notice Regarding the Bringing into Effect of an Environmental Emergency Plan (Schedule 4) that are submitted to ECCC and NOT the E2 Plan itself. However, E2 Plans can be requested by ECCC's Enforcement Branch to conduct a compliance inspection.

It is strongly recommended that local first responders are engaged in the development, creation, and exercising of E2 Plans whenever possible. Ideally, a summary of the E2 Plan should be prepared in advance to share with first responders before they arrive to respond to an environmental emergency. Where possible, the desired contents of this summary should be discussed in advance with the local first response community.

*****NOTE***:** Even if your facility does not meet the criteria for creating an E2 Plan, ECCC strongly recommends that you create an emergency plan voluntarily to protect people, the environment and property.

Regulatory Requirements vs Best Practices

The following section provides suggestions on the format and content of an E2 Plan. Some of these are recommendations based on applicable standards and industry best practices that are ***not*** prescribed by the E2 Regulations.

For clarity, items not required under the regulations are highlighted in green text and preceded by an asterisk (*), or preceded by words such as "recommend", "suggest", "may", "could" and "should". Regulatory requirements are associated with words such as "must" or "required".

Please note that any identified standards are recommendations for voluntary use. Reference to and use of the standards can be used to demonstrate how the requirements for an E2 Plan have been satisfied.

5.1 Approach to developing a plan

The purpose of emergency planning is to reduce and/or eliminate the risks of natural or human-induced disasters for human health and the environment. Undesirable events such as the release of hazardous substances could occur as a result of process, procedure or equipment failures. E2 Plans must integrate all relevant aspects of risk management to account for scenarios that would likely cause harm to the environment or constitute a danger to human life or health by providing proactive identification, assessment, prevention, and mitigation measures.

The regulatory requirements for the contents of an E2 Plan can be found in Section 4 of the E2 Regulations. ECCC suggests the following method for the development of the E2 Plan:

1. Identify all potential facility hazards;
2. Develop a list of environmental emergency scenarios associated with the facility hazards, including the one described in section 4(2)(e) of the E2 Regulations;
3. Identify potential consequences of those scenarios including a prediction of the spatial extent of potential impacts (i.e. predict impact zone/radius and identify what receptors fall within the impact zone and how they would be affected by the release);
4. Assess the probability or likelihood of such scenarios occurring;
5. Estimate and evaluate the risk associated with all identified scenarios; and

6. Develop an E2 Plan to prevent, prepare for, respond to and recover from those impacts and consequences.

Each of the elements listed above will be elaborated upon in the upcoming sections of this document.

A list of references that could be used for the preparation of an E2 Plan is provided in Appendix 6. A checklist containing elements for the preparation of an E2 Plan is also provided in Appendix 7. These are provided for convenience only; their use is not mandatory.

5.2 Adequate measures

Subsection 4(4) of the E2 Regulations requires that an E2 Plan include adequate measures to address the objectives of preventing, preparing for, responding to and recovering from the environmental emergencies identified under paragraph 4(2)(d). If the prepared E2 Plan is not appropriate/adequate for an environmental emergency that occurs, the facility will be held responsible.

These measures are not prescribed by the E2 Regulations. They need to be determined by the facility on a case by case basis, taking into consideration site specific details. It is also expected that the responsible person will modify the E2 Plan to correct any inadequate measures as they are identified.

Please note that the preparation of an E2 Plan on its own is not sufficient to ensure compliance with the E2 Regulations. The availability and quality of the measures described in the E2 Plan must be concretely able to be deployed in order to meet the objectives of the E2 Regulations.

5.3 Environmental Emergency Plan content

When an E2 Plan is required, it may be prepared in the format that makes the most sense to a facility, provided it contains, at minimum, the required elements set out in Section 4 of the E2 Regulations. The following are ***suggestions*** on the layout and content of an E2 Plan. Sections may be re-ordered, added, or removed entirely to address site specific issues and conditions. It is incumbent on the responsible person to use their professional judgement to develop an E2 Plan for their facility that addresses all regulatory requirements.

The format suggested in the following section does not necessarily follow the E2 Plan requirements as listed alphabetically in the subsections in the E2 Regulations (i.e. 4 (2) (a) to 4 (2) (o)). Instead, it is presented so that it follows the layout outlined in the template Table of Contents listed in Appendix 8. References to the applicable regulatory sections are highlighted in a red Information text box at the beginning of each section.

For ease of use, the following table also provides hyperlinks to the relevant sections

pertaining to each regulatory element:

Table 3 – E2 Plan Contents at a Glance

Paragraph in E2 Regulations	Description		Location(s) in Technical Guidance Manual
4(2)(a)	Property and substance characteristics		5.3.4 Facility Overview 5.3.5 Identification and Assessment of Environmental Emergency Scenarios
4(2)(b)	Activities involving the substance(s)		5.3.4 Facility Overview 5.3.5 Identification and Assessment of Environmental Emergency Scenarios
4(2)(c)	Facility and surrounding area		5.3.4 Facility Overview 5.3.5 Identification and Assessment of Environmental
4(2)(d)	Identification of environmental emergencies		5.3.5 Identification and Assessment of Environmental Emergency Scenarios
4(2)(e)	Worst-case scenario		5.3.5.3 Identification of Environmental Emergency Scenarios
4(2)(f)	Alternate worst-case scenario		5.3.5.3 Identification of Environmental Emergency Scenarios
4(2)(g)	Prevention, preparation, response, and recovery measures		5.3.6 Prevention and Mitigation 5.3.7 Preparedness 5.3.8 Response 5.3.9 Recovery/Restoration
4(2)(h)	Roles and responsibilities		5.3.7 Preparedness 5.3.8 Response
4(2)(i)	Environmental emergency training		5.3.7 Preparedness
4(2)(j)	Emergency response equipment		5.3.7 Preparedness 5.3.8 Response 5.3.9 Recovery/Restoration
4(2)(k)	Communication in advance of emergency		5.3.7 Preparedness
4(2)(l)	Communication during and after emergency		5.3.7 Preparedness 5.3.8 Response 5.3.9 Recovery/Restoration
4(2)(m)	Personnel responsible for communications		5.3.7 Preparedness 5.3.8 Response 5.3.9 Recovery/Restoration
4(2)(n)	Consultations with local authorities		5.3.7 Preparedness
4(2)(o)	Plan (map) with location of substances		5.3.4 Facility Overview
4(3)	Existing E2 Plan		5.3.1 Executive Summary 5.4.2 Existing plan
4(10)	Updates to the E2 Plan		5.4.4 Annual Review of the E2 Plan
4(11)	Access to the E2 Plan		5.4.3 Location of E2 Plan documentation

5.3.1 Executive Summary

*It is recommended that the first page of the plan be a summary pull-out that describes the steps required to activate the E2 Plan and contains information that might be required by first responders arriving at the scene. Ideally, it would be laminated or protected by a plastic sheath to avoid damage while in use. Where possible, the desired contents of this summary should be discussed in advance with the local first response community.

5.3.2 Introduction

Regulatory Aspects Addressed in the Introduction Section

4 (3) For the purposes of subsection (1), a responsible person may use an environmental emergency plan that has been prepared on a voluntary basis, or for another government or under another Act of Parliament, if that plan meets the requirements of subsection (2) or is amended so that it meets those requirements.

This section of the E2 Plan should provide a frame of reference for the plan and could include the elements outlined below. Please note that although item (g) is a regulatory requirement, it may be included elsewhere in the E2 Plan should a facility choose not to include an introductory section.

a) *A policy statement reflecting senior management's commitment to develop and support an emergency management program to safeguard the health and safety of the employees and the public, and to protect the environment and property.

b) *The purpose or intent of the plan (i.e. to assess facility hazard risks and establish a state of readiness to prepare for a prompt and orderly response to and recovery from any emergency);

c) *The key priorities of the plan (i.e. protecting lives and preventing injuries for the public, employees and contractors; protecting the environment, protecting property, minimizing disruption of business activities, etc.);

d) *The objectives of the plan (measurable and specific) which forms the basis for any performance measure analysis (i.e. understanding the type and extent of potential emergency scenarios; establishing adequate preparedness measures; ensuring timely and adequate response measures are in place; providing incident management teams with clear lines of authority and access to resources; conducting response and recovery operations in accordance with site safety plans; complying with applicable legislation; minimizing impacts to environments;

providing timely, factual notifications/updates to regulators, public safety authorities, media, public; etc.);

e) *A description of the scope which will define the boundaries (geographic and physical location) covered by the plan, limitations of the plan, and the types of emissions the plan covers (i.e. air, land, water);

f) *The plan distribution (internal and external) network and a description of how key stakeholders access the plan (including local public safety authorities);

g) The identification of any existing joint/or linked Emergency Response Plans created voluntarily or under another piece of legislation that may be used as a substitute or augment the requirements for an E2 Plan as stipulated in the *Environmental Emergency Regulations*, 2019;

h) *The identification of any other organizations or groups having responsibility under the plan;

i) *The identification of any other organizations or groups that were consulted as part of the plan development (i.e. local interest groups, public, public safety authorities, etc.);

j) *A Record of Amendments for tracking updates to the E2 Plan (Could also be kept at the beginning or end of the document for ease of use); and

k) *A Glossary/Definitions/Acronyms section.

5.3.3 Management and Administration of the E2 Plan

Regulatory Aspects Addressed in the Administration Section

10 A responsible person must review and, if necessary, update the environmental emergency plan at least once a year to ensure that it continues to meet the requirements of subsection 4(2) and keep a record of the date of the review.

11 A responsible person must make a copy of the environmental emergency plan readily available at the facility referred to in subsection 4(1) and at any other place where a copy of the plan needs to be kept for consultation by the individuals who are to carry it out.

Although not a regulatory requirement that must be included in the E2 Plan, the facility must review the E2 Plan annually (at a minimum) and update it as necessary. This section could contain a description of the planning process used to develop, implement, and maintain the E2 Plan, including:

a) *A description of the E2 Plan Development Team (if applicable) and/or the title/position of the person who is responsible for coordinating the development and administration of the plan.

b) *A description of the organizational structure showing the lines of authority and the position titles responsible for performing activities associated with the development, implementation and maintenance of the E2 Plan. This should include but not necessarily be limited to the responsible person and primary and secondary facility contacts.

c) *A description of the process and schedule for the review, evaluation, and update of the E2 Plan. Updates may also be required to take into account: lessons learned from real incidents or simulation exercises; changes in factors such as operational, organizational, personnel, or regulatory requirements; or changes in facility hazard risk levels. (Note that although this is a requirement of Section 10 of the E2 Regulations, it need not be part of the E2 Plan itself.)

d) *A description of the process for senior management review and approval of the plan and any associated updates.

e) *A description of how the plan is distributed/accessed by key stakeholders once an update has been completed.

5.3.4 Facility Overview

Regulatory Aspects Addressed in the Facility Overview Section

4(2)(a) a description of the properties and characteristics of the substance and the maximum expected quantity of the substance at the facility;

4(2)(b) a description of the commercial, manufacturing, processing or other activity involving the substance that takes place at the facility;

4(2)(c) a description of the facility and of the area surrounding the facility that may be affected by an environmental emergency referred to in paragraph (d), including any hospitals, schools, residential, commercial or industrial buildings and any highways, public transit infrastructure, parks, forests, wildlife habitats, water sources or water bodies

4(2)(o) a plan of the facility showing the location of any substances in relation to the physical features of the facility

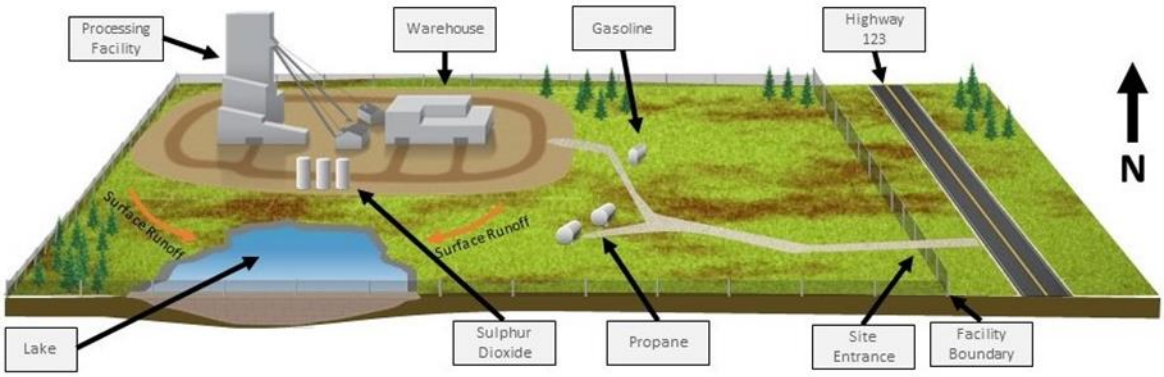
This section of the E2 Plan must contain the items listed below, and numbered from (a) to (e). How this is accomplished is at the discretion of the responsible person.

a) A description of the facility and property, including a plan of the facility that at minimum, shows the location of regulated substances in relation to the physical features of the facility. An example can be found in figure 2 below. The following items may also be included as part of the description:

- Maps / schematics / diagrams (e.g. process flow diagrams, piping and instrumentation diagrams (PIDs), etc.)
- Descriptions of container systems, reactors, process, piping, etc.
- The location of potential hazards (i.e. contributing factors, other non-E2 hazardous substances, etc.).

b) The maximum expected quantity of the E2 substance(s) at the facility, both contained and uncontained. Ideally, this will include the number of container systems and container system capacities (if applicable), and should match up with the amount submitted in the Schedule 2 notice for the facility.

Figure 2. Example Facility plan with location of regulated substances



c) A description of the properties and characteristics of the E2 substances on site. This may include, but is not limited to:

- Identification Information – chemical name, CAS#, and UN Number (if applicable, these are required for the submission of various notices);
- Properties – pH, vapour pressure, boiling point, density, solubility and other physical/chemical properties; and
- Characteristics – toxicity data, reactivity, incompatibilities, flammability and state (e.g., liquefied gas under pressure).

Incompatible substances or substances that are reactive with fire suppression agents (including non-E2 substances that may contribute to an E2 release scenario) should be clearly identified in the plan. A good source for this information would be a safety data sheet (SDS) from the supplier. The most up to date version of the SDS should be used to ensure that the E2 Plan is accurate.

d) A description of the industrial processes. This requires describing how the substance is used on-site (stored, produced, manufactured, reacted, used as a refrigerant, etc.). If the substance is used within a larger system, the facility may wish to also represent that system in a figure. This diagram as well as a description of the activity in which the substance is involved will better describe the use of the substance on-site. An example is provided in Figure 3 below for any facility that wishes to proceed in this manner.

Example: XYZ Cold Storage is a cold storage facility that operates mechanical compression refrigeration systems. Anhydrous ammonia is used as the refrigerant and is handled in a closed loop.

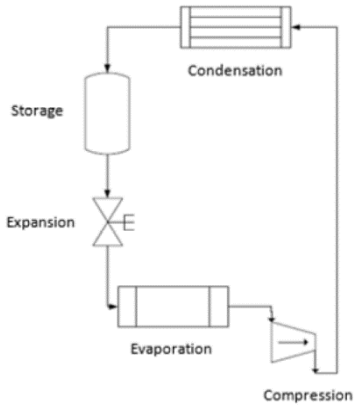


Figure 3: Mechanical Refrigeration Cycle

e) A description of the area surrounding the facility that may be affected by the environmental emergencies identified in the E2 Plan. The list of potential receptors provided in paragraph 4(2)(c) of the E2 Regulations is not exhaustive. The examples provided are to be included if present; however, other receptors such as child care centres, senior citizen and long-term care facilities, public camping facilities, wetlands, etc. must also be described if relevant. This section of the E2 Plan must also identify any transportation corridors not owned and operated by the facility, and any key features that may act as discharge points to off-site areas, such as culverts, catch basins, streams, etc.

The responsible person must use their professional judgement in the determination of what elements to include in the E2 Plan when describing the surrounding environment. Methods in which to provide the information may include lists, maps, and tables. If possible/practicable, approximate distances from the facility to the different receptors should also be identified.

Figure 4: Example Map of Surrounding Area

5.3.5 Identification and Assessment of Environmental Emergency Scenarios

Regulatory Aspects Addressed in the Identification and Assessment of Environmental Emergencies

4(2)(a) a description of the properties and characteristics of the substance and the maximum expected quantity of the substance at the facility

4(2)(b) a description of the commercial, manufacturing, processing or other activity involving the substance that takes place at the facility;

4(2)(c) a description of the facility and of the area surrounding the facility that may be affected by an environmental emergency referred to in paragraph (d), including any hospitals, schools, residential, commercial or industrial buildings and any highways, public transit infrastructure, parks, forests, wildlife habitats, water sources or water bodies;

4(2)(d) an identification of any environmental emergency that could reasonably be expected to occur at the facility and that would likely cause harm to the environment or constitute a danger to human life or health, including the environmental emergency referred to in paragraph (e) and, if applicable, the environmental emergency that is more likely to occur than the environmental emergency referred to in paragraph (e) and that would have the longest impact distance outside the boundary of the facility;

4(2)(e) an identification of the harm to the environment or danger to human life or health that would likely result from an environmental emergency involving the release of:

- *(i) the maximum quantity of the substance that could be contained in the container system that has the largest maximum capacity, if a quantity of the substance is in a container system, and*
- *(ii) the maximum expected quantity of the substance that will not be in a container system, if a quantity of the substance is not in a container system*

4(2 (f) an identification of the harm to the environment or danger to human life or health that would likely result from the environmental emergency identified under paragraph (d), if any, that is more likely to occur than the environmental emergency referred to in paragraph (e) and would have the longest impact distance outside the boundary of the facility

Section 4(2)(d) of the E2 Regulations requires the identification of the worst-case scenario and any other environmental emergencies that could reasonably be expected to occur and would likely cause harm to the environment or constitute a danger to human life or health. Sections 4(2)(e) and 4(2)(f) of the E2 Regulations require the identification of the harm that would likely result from the release of regulated substances during the worst-case and alternate worst-case (if applicable) scenarios.

The use of a risk analysis approach is recommended to help facilities assess which hazards pose the greatest risk both in terms of how likely they are to occur and how great the potential consequences of a release may be. This approach, an example of which is outlined in the following sections, also helps highlight existing preventive or mitigative barriers and identify whether additional safety barriers or risk control measures should be added to manage any residual risks.

If a facility chooses not to undertake a risk analysis approach, they are still required to fulfill the obligations outlined in Table 4. It is incumbent on the responsible person to use their professional judgement in the determination of how this can best be accomplished.

Table 4. Minimum Regulatory Requirements for E2 Scenarios in an E2 Plan

Section in E2 Regulations	Element	Location in Document
4(2)(d)	Identify any environmental emergency scenario that could reasonably be expected to occur at the facility.	5.3.5.3 Identification of Environmental Emergency Scenarios
4(2)(d)	Identify the scenario described in Section 4(2)(e) of the E2 Regulations (worst-case scenario).	5.3.5.3 Identification of Environmental Emergency Scenarios
Not specified but required to fulfill 4(2)(f)	Determine the likelihood of the scenarios and identify those more likely to occur than the worst-case scenario (if any).	5.3.5.5 Likelihood/Probability Analysis
Not specified but required to fulfill 4(2)(f) and Schedule 3	Determine the impact distance of the scenarios identified in the step above (if any) and the worst-case scenario. Note that the impact distances for the worst-case and alternate worst-case scenarios, and their method of determination, must be reported in Notice Regarding the Preparation of an E2 Plan (Schedule 3).	5.3.5.4 Consequence/Impact Analysis - Harm to the Environment or Danger to Human Life and Health

Section in E2 Regulations	Element	Location in Document
4(2)(f)	Identify the scenario more likely to occur than the worst-case scenario that has the longest impact distance outside the facility boundary, if it exists (alternate worst-case scenario).	5.3.5.3 Identification of Environmental Emergency Scenarios
4(2)(e)	Describe the harm to the environment or danger to human life or health that would likely result from the worst-case scenario.	5.3.5.4 Consequence/Impact Analysis - Harm to the Environment or Danger to Human Life and Health
4(2)(f)	Describe the harm to the environment or danger to human life or health that would likely result from the alternate worst-case scenario (if it exists).	5.3.5.4 Consequence/Impact Analysis - Harm to the Environment or Danger to Human Life and Health

5.3.5.1 Hazard Identification and Risk Assessment (HIRA)

The following steps involved in risk analysis have been adapted from CRAIM, 2017, but other methods may also be used. The process includes:

1. Identifying hazards and release scenarios:
    a. Identify the hazards that are inherent to the E2 substance (i.e. SDS);
    b. Identify the hazards associated with facility processes;
    c. Identify a list of hazardous scenarios – worst-case, alternate worst-case, and other reasonable scenarios.
2. Identifying and estimating the possible consequences and impacts of the scenarios associated with those hazards (i.e. impact distance modelling where possible).
3. Estimating the likelihood or probability of identified scenarios (other than the worst-case).
4. Estimating the risk (i.e. risk matrix).
5. Evaluating the risk

5.3.5.2 Hazard Analysis

This section of the E2 Plan consists of an analysis of all potential on-site and off-site hazards of the facility's operation(s) associated with the processes utilizing E2 substances. The output of this analysis is a list of potential environmental emergency scenarios that are reasonably expected to occur, and the scenario described in Section 4(2)(e) of the E2 Regulations (worst-case scenario).

Information to be considered in the hazard identification must focus on both the characteristics of the substance(s) stored/used, and the onsite processes. This includes the creation of any intermediate E2 substances. As part of an all hazards approach, it is recommended that the effects of human activities, technological events and natural disasters be considered as part of this analysis. The analysis of natural disasters should focus on those that are most likely to occur in the area.

Hazards Inherent to the E2 Substance(s)
Regulated substances are classified based upon the type of hazard they present, as indicated in column 5 of Schedule 1 of the E2 Regulations. There are six hazard categories: aquatically toxic (A), combustible (C), explosion hazard (E), pool fire hazard (F), inhalation hazard (I), and oxidizer that may explode (O). If a substance is associated with multiple hazard characteristics that could impact the environment and / or human life and health, they must all be considered and planned for when identifying scenarios and the potential harm that might result. For example, although an acid might be classified as an inhalation hazard, it could also exhibit aquatically toxic characteristics in the event that it were released to a waterbody. In situations such as this, both scenarios/hazards must be considered for the E2 Plan.

Some of the information required to evaluate the hazards inherent to the substance(s) in the E2 Plan may have already been collected while preparing the section on the Facility Overview (Section 5.3.4 of this document). Items that can be taken into consideration and/or reviewed include but are not limited to:

- Safety Data Sheets (SDSs) for toxicological, physical and chemical properties;
- Incompatibility of substances or those that are reactive with fire suppression agents (including non-E2 substances that may contribute to an E2 release scenario);
- Other sources of data on health or toxic effects (AEGL Level data, ERPG Level data, IDLH data, NIOSH Guide Information, ACGIH data, Fire and Explosion data, etc.)

Hazards Associated with Facility Processes
Information on the facility process(es) would have been collected for the Facility Overview section of the E2 Plan. Additional items that could be taken into consideration when identifying associated hazards include, but are not limited to:

- Previous incidents/near misses;

- Relevant incidents within the industry and/or similar facilities (Industry associations and regulators may be a source for this type of information);
- Corporate Insurance Risk Processes;
- Facility and/or process design (including potential process upsets or changes);
- Geographic location;
- Results of job safety analysis

Hazard Analysis

Once relevant data has been collected, several recognized methods for identifying hazards and estimating risks could be applied. They encompass qualitative, semi-quantitative and quantitative approaches. Methods, in no particular order or preference, include:

- Checklists;
- What-If? Analysis;
- What-If? Analysis/Checklist combination;
- Screening Level Risk Assessment (SLRA);
- Hazards and Operability (HAZOP) study;
- Event Tree Analysis (ETA);
- Fault Tree Analysis (FTA);
- Bow-tie Analysis;
- Failure Mode and Effect Analysis (FMEA);
- Failure Mode, Effects, and Criticality Analysis (FMECA);
- Index Methods (i.e. Dow Fire and Explosion, Dow Chemical Exposure, etc.)
- Layers of Protection Analysis (LOPA);
- Security Vulnerability Analysis (SVA);
- Quantitative Risk Analysis (QRA); and
- Other methods

Once the hazard analysis has been completed, potential environmental emergency scenarios can be identified.

5.3.5.3 Identification of Environmental Emergency Scenarios

An environmental emergency included in an E2 Plan must have the potential to harm the environment, or constitute a danger to human life or health. The scenarios must account for emergencies with impacts both inside and/or outside of the site boundaries of the facility. If a substance is associated with multiple hazard characteristics that could impact the environment and / or human life and health, they must all be considered when identifying scenarios. For the purpose of satisfying the scenario development requirements of the E2 Regulations, ***the E2 Plan must clearly identify***:

1. **A worst-case scenario for each E2 substance**. As described in Section 4 (2)(e) of the E2 Regulations, this must be based on a release involving the maximum quantity of an E2 substance that could be contained in the largest container

system, ***or*** the maximum expected quantity of an uncontained substance. Safe fill limits may not be taken into account for this determination. The worst-case scenario must be developed irrespective of the scenario's likelihood or probability. Passive mitigation measures may be considered for the analysis of this scenario, provided that the passive mitigation system is capable of withstanding the event that triggered the release (e.g., catastrophic vessel rupture, etc.) and still function as intended.

2. **A list of all other potential scenarios that are reasonably expected to occur** for each E2 substance identified in the E2 Plan. Active and passive mitigation measures that are able to withstand the event that triggered the release (i.e., catastrophic vessel rupture, etc…) and still function as intended may be considered for the analysis of all of these scenarios. Safe fill limits may also be taken into account. Examples of alternate scenarios include, but are not limited to:

    - Process Vessel/Pump releases – due to cracks, seal failure, etc.;
    - Transfer hose releases – line break, uncoupling;
    - Corrosion of means of the containment system;
    - Weld failure;
    - Process piping release – line breakage, failures of flanges, joints, valve and valve seals, etc.
    - Vessel overfilling and release; or overpressurization and venting through relief valve or rupture disks;
    - Release of inhalation toxics of short duration
    - Release of an intermediate E2 Substance from a process unit
    - Release occurring during the loading/unloading of a substance from transportation vessel (scenario may be voluntarily included even if TDGA exemption applies)
    - Vehicle collision with a container system resulting in rupture
    - Ignition of leaking substance from nearby heat source
    - An explosion involving a quantity of ammonium nitrate stored loosely in a pile or in containers in a warehouse
    - Failure of automated process control mechanisms, alarms, etc…
    - Fire at a facility, process or non-process related
    - Extreme weather event that impacts a facility
    - Natural disaster that impacts a facility

Passive and Active Mitigation Measures

Passive mitigation *is defined as a safeguard system designed to mitigate the consequences of an incident that does not require human intervention, external mechanisms or energy sources. Examples include secondary containment, diking/curbing, firewall, blast wall, etc.*

Active mitigation *is defined as a safeguard system designed to mitigate the consequences of an incident that requires human intervention, external mechanisms or energy sources. Examples include sprinkler system, water curtain/deluge, automatic valve, flare, etc.*

3) **The alternate worst-case scenario for each E2 substance (if it exists)**

In order to identify the alternate worst-case scenario, as described in section 4(2)(f) of the E2 Regulations, the list of alternate scenarios identified in step 2, above must be evaluated to determine which one:

- is more likely to occur than the worst-case scenario identified in Step 1 above (4(2)(e)), ***and***
- has the longest impact distance outside the facility boundary.

In order to proceed with this step, every scenario will need to be evaluated in order to identify those which are more likely to occur than the worst-case scenario. The impact distance for those scenarios (if any) will then need to be determined to identify the scenario with the longest impact distance outside the boundary of the facility. (Active and passive mitigation measures that are able to withstand the event that triggered the release and still function as intended may be considered for this analysis. Safe fill limits may also be taken into account.)

Suggestions on how these analyses could be carried out can be found in the next several pages. Other methods may also be available from other sources. The responsible person must use their professional judgement to determine the methodology to undertake these evaluations that is best suited for their facility.

The alternate worst-case scenario will become the basis for the Public Notification "before an emergency" requirements as described in Section (4)(2)(k) of the E2 Regulations. If an alternate worst-case scenario cannot be identified, then Section 4(2)(k) of the E2 Regulations does not apply and advance public notification is not necessary for that substance. Additionally, the full scale simulation exercise will be have to be conducted based on the worst-case scenario.

5.3.5.4 Consequence/Impact Analysis - Harm to the Environment or Danger to Human Life and Health

For the purposes of E2 planning, the consequences/impact analysis should focus initially on the hazard category assigned to the substance in Schedule 1 of the E2 Regulations, and then on any other secondary hazard characteristics. It is also recommended that domino effects and /or knock on effects (where one event leads to or causes another) be included as part of the analysis.

The intent of this exercise is not to capture accidental by-products that might result from an environmental emergency (e.g., substances that might be created in a fire). However, if the possibility of the production of a hazardous substance is known and the concentration sufficiently high to cause inhalation toxicity, then the facility should be prepared for that outcome.

Although accidental by-products of an environmental emergency are not reportable under the E2 Regulations, quantities of intermediate substances created intentionally as part of a manufacturing process must be taken into account if their concentration meets or exceeds the threshold criteria.

Domino and Knock-On Effects

The intent of taking domino and knock-on effects into consideration as part of the consequence analysis is to ensure that anything that might result in an increase in the risk or consequences of a release is evaluated. This could include the effects of the release on nearby stored substances, e.g., shrapnel created during an explosion that ruptures a nearby tank storing a different substance. It may also pertain to the potential impacts created as a result of the release's effect on substances stored at another facility located in sufficient proximity. For example, a fire in one storage tank may heat up a tank on a neighboring property and cause a secondary explosion.

These types of events are site specific. It is expected that the responsible person would use professional judgement in identifying any potential effects and determining whether or not they should be factored into their modelling. Decisions as to how domino and knock-on effects are dealt with should be documented to demonstrate that the risks from each scenario have been sufficiently estimated.

Leased or Rental Properties / Land Access Agreements

For the purposes of this exercise, if a facility leases or rents property to another industry, that industry would be considered to be outside of the fence line of the original facility, as it is a separate entity in relation to the one leasing the property. This may affect the calculation of the impact distance outside the boundaries of a facility, and the associated reporting requirements.

If the industry leasing the property had E2 substances onsite that were above reporting thresholds in Schedule 1 of the E2 Regulations, they would be required to notify as a

separate facility. Environmental emergency scenarios involving the industry leasing the property would not be included in the original facility's (leasor) E2 Plan unless there is a possibility of domino or knock-on effects.

If a facility has provided access to their property to a third party entity (e.g., a trapper), that entity should be advised of the potential that an environmental emergency could occur and any of any required safety measures.

Methodology for Consequence Analysis

Typically, a consequence analysis exercise is carried out using modelling or data tables. Approaches for conducting a consequence analysis can be simplistic (more conservative results) or complex (less conservative results) and can be categorized into four basic approaches:

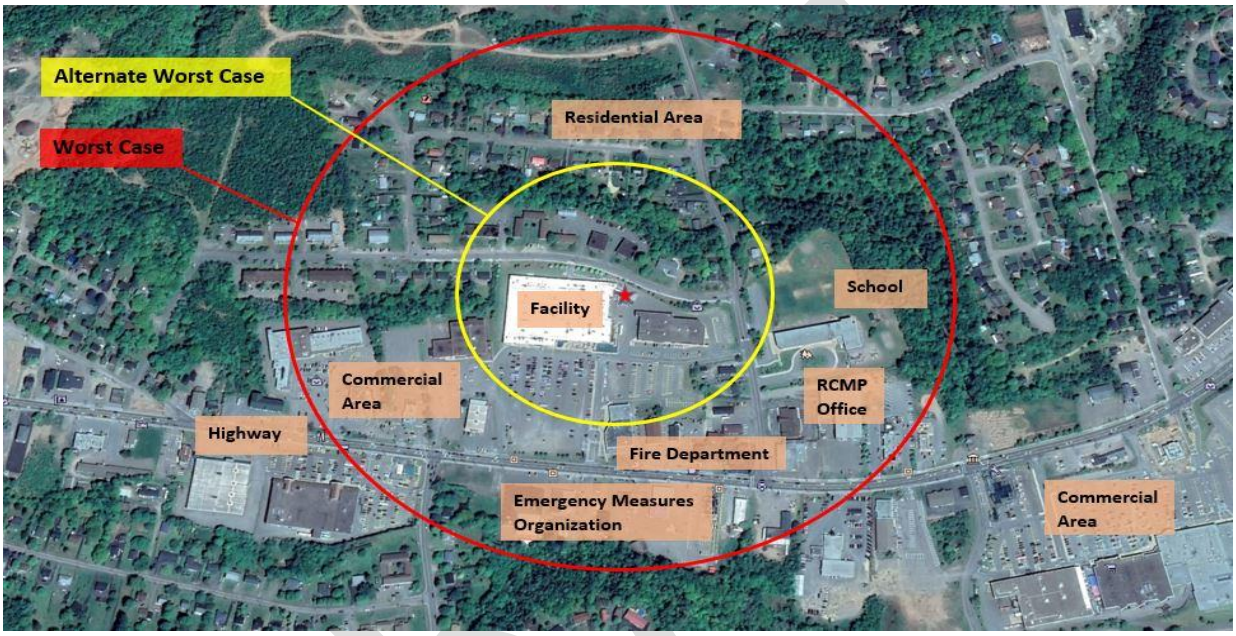
1. Simple Guidance – utilizes conservative reference guides/data tables with limited ability to adjust site specific factors. The information is sourced from research, modeling and experience that outline predictable outcomes of incidents. Examples include: EPA's Offsite Consequence Analysis Guide, Emergency Response Guides, CRAIM Tables, industry associations, etc.
2. Relatively Simplistic Computer Models - utilize conservative models with limited ability to adjust site specific factors, often providing more conservative results. Examples include: EPA RMP COMP, ALOHA, ADAM, etc.
3. Complex Computer Models – Commercially available models that can consider many site specific factors and typically provide less conservative (i.e., more realistic) results than more simplified methods. Some may use a stochastic approach (an ensemble of different outputs where a probability contour map is produced) or a deterministic approach (where limited or single release scenarios are run). This approach typically requires a high level of expertise to use. Examples include: PHAST, OILMAP, OILMAPLAND, SIMAP, CHEMMAP, and SAFER TRACE, etc.
4. Calculations Methods – Utilize established equations that can consider many site specific factors. This typically require a high level of expertise to use. Examples include: "Yellow Book", TNO multi-energy model, Baker-Strehlow Model, CRAIM Equations, etc.

Key parameters when modelling scenarios include factors such as: the physical and chemical properties of the substance, quantities, rate and duration of the release, endpoints, wind speed/atmosphere stability, ambient temperature/humidity, height of release, topography, buoyancy (for gases), temperature of substance, etc. Endpoints are typically established criteria associated with health effects or toxicity effects. Commonly used references for endpoints can be found in Appendix 9 of this document.

An output of the Consequence/Impact Analysis could include maps showing the worst-case scenario and alternate worst-case scenario. Maps of the other alternate scenarios

may also be included. ***At minimum, the impact distances of the worst-case and alternate worst-case scenarios, and a description of the potential harm/danger resulting from those scenarios, must be included in the E2 Plan. The methods used to determine the impact distances must also be reported in the Notice Regarding the Preparation of an Environmental Emergency Plan (Schedule 3).***

Fig. 5 Example Impact Zone Map



5.3.5.5 Likelihood/Probability Analysis

In order to assist in identifying the alternate worst-case scenario, this section of the E2 Plan involves performing a comparison of the estimated likelihood or probability of potential scenarios occurring. Typical likelihood categories expressed in qualitative based risk matrices range from Very Unlikely (i.e. rare) to Very Likely (i.e. almost certain). Suggestions for hazard identification analysis techniques utilizing a semi-quantitative or qualitative frequency analysis approach include Fault Tree, Event Tree, and Bow-tie analysis.

Note that for the worst-case scenario described under Section 4(2)(e) of the E2 Regulations must be developed irrespective of the scenario's likelihood or probability. It will then be used as a basis to determine which alternate scenarios are more likely to occur. These will then be further evaluated to identify the alternate worst-case scenario.

Risk Estimation

This section of the E2 Plan consists of a description of the estimated risk level for all scenarios based on their consequences and likelihood/probability. Hazard scenarios should be ranked in a logical fashion to indicate the level of risk. One method to rank risks is to develop a risk matrix. A risk matrix is a categorization and ranking tool that helps evaluate risks through a comparison of the likelihood or probability of the risk and the severity of the consequences. Risk levels may be expressed as being high to low, or in terms of intolerable to tolerable. A risk matrix is typically used to estimate risk levels for scenarios developed through the qualitative and semi-quantitative hazard identification analysis methods (e.g., Checklist, What-if?, HAZOP, FMEA, Bow-tie, etc.).

		Impact				
		Negligible	Minor	Moderate	Significant	Severe
Likelihood	Very Likely	Medium	Medium	High	High	High
	Likely	Low	Medium	Medium	High	High
	Possible	Low	Medium	Medium	Medium	High
	Unlikely	Low	Low	Medium	Medium	High
	Very Unlikely	Low	Low	Low	Medium	Medium

Figure 6: Example Risk Matrix Table (for example purposes only – not a recognized ranking scheme)

As suggested, a quantitative risk assessment approach (e.g., QRA, etc.) may quantify the risk in terms of a numerical risk value (i.e. 1 x 10^{-7} fatalities per year) compared against an established criteria (i.e. an individual and/or societal risk criteria). Results are then typically presented in the form of a risk contour map or presented as a risk profile (i.e. Aggregate/Societal Risk F-N Curve – Frequency vs Consequence). A risk analysis may also identify areas for the implementation of additional preventative measures.

Risk Evaluation

Following the risk analysis, a risk evaluation could then be carried out to determine whether the level of risk is considered tolerable or whether additional residual risk reduction measures are required. In order to proceed with this, acceptable risk criteria must first be defined. Given the diverse nature of regulated facilities, this will not be addressed in the Technical Guidelines. A small number of the publications referenced in Appendix 6 speak to consequence/risk analysis; however, that is not their primary intent. It is incumbent on the responsible person to define acceptable risk criteria for their scenarios.

5.3.5.6 E2 Plan Development Following Assessment of Potential Environmental Emergencies

Once the potential environmental emergencies have been assessed, additional aspects of the E2 Plan can be developed based upon the information from the identified scenarios, their potential impact zones, and the consequences/receptors in those zones. Section 4(2)(g) of the E2 Regulations requires that E2 Plan describe the prevention, preparedness, and response and recovery measures for the scenarios identified in the E2 Plan. A facility may already have programs/plans in place that address or partly address these issues. They can be used, and supplemented where necessary, to fill any gaps between those programs and the regulatory requirements.

5.3.6 Prevention and Mitigation

Regulatory Aspects Addressed in the Prevention and Mitigation Section

4(2)(g)a description of the measures to be taken to prevent and prepare for the environmental emergencies identified under paragraph (d) and the measures that will be taken to respond to and recover from such emergencies if they were to occur

4(4) The measures included in the environmental emergency plan must be adequate to address the objectives of preventing, preparing for, responding to and recovering from the environmental emergencies identified under paragraph (2)(d)

Environmental emergencies can be averted or their severity limited by identifying in advance the cause of their probable frequency, potential consequences and impacts. Prevention includes the strategies, actions, programs, and systems established in advance to eliminate or prevent the hazards or risks associated with a particular activity or to reduce the likelihood of an hazardous event occurring.

The prevention approach follows the principles of inherent safety, in which safety is incorporated as part of the fundamental design of a process, rather than being employed through the addition of safeguards once installation is complete. Through this, facilities may see a reduction in the number, complexity, and severity of hazards scenarios associated with the storage or use of hazardous substances.

The four main principles of inherent safety are minimization, substitution, moderation, and simplification.

The facility must describe the preventive measures that will be implemented for the scenarios identified in the E2 Plan. The items identified below are examples of measures

that could satisfy regulatory requirements. Others are also available. The responsible person must implement the measures that are best suited for their facility.

a) Legislation and Industry Standards – identification of any applicable regulations, standards (including industry based), and codes of practice (i.e. CSA B149 Propane Installation Code, Anhydrous Ammonia Code of Practice, etc.) that are followed as part of their emergency/risk management program.

b) A description of any Prevention through Design aspects (if applicable) that were applied during the facility siting, facility design or process design stage to anticipate and design out hazards throughout the life cycle of materials and processes to workers, work practices, processes, equipment, substances, and new technologies (e.g., dikes, catch basins, etc.).

c) A description of any Process Safety Management (PSM) system (if applicable) in place in place at the facility. To prevent process-related injuries and accidents, many process industries in Canada use chemical PSM systems. PSM is the application of management principles and systems for the identification, understanding, avoidance and control of process hazards to prevent, mitigate, prepare for, respond to and recover from process-related incidents (e.g., ISO requirements).

   In Canada, the first edition of the CSA Z767-17 standard on PSM was published in 2017. It identifies the requirements of a PSM system for facilities and worksites handling or storing substances that are potentially hazardous, either due to an inherent chemical, biological, toxicological or physical property of those substances, or due to the substance's potential or kinetic energy. References for PSM can be found in Appendix 6

d) A description of any aspects of a Hazard Control Program (if applicable) or procedure in place at the facility. Hazard control programs typically follow a "hierarchy of control" approach and include the following elements:

   a. Elimination – removing the hazard from the workplace. This also may include eliminating human interaction in the process, or automating tasks
   b. Substitution – replacing hazardous substances with less hazardous ones (e.g., chlorine with sodium hypochlorite).
   c. Engineering controls – equipment, ventilation systems, and processes to reduce the source of exposure. This includes worker safeguards, container system design, secondary containment, emergency shut-off devices, pressure and temperature gauges, excess flow valves, pressure relief valves, hydrostatic relief valves, internal safety control (ISC) valves, flow indicators, electrical bonding/grounding systems, etc.

d. Awareness - systems that increase awareness of potential hazards at the facility (e.g., detectors, lights, alarms, signage, labels, notification systems) including training programs for staff, contractors and visitors.

e. Administrative controls - controls that alter the way the work is done, including timing of work, policies and other rules, and work practices such as operating procedures, training programs for operators, equipment inspections, or incident investigations. This may also include any preventative maintenance programs, mechanical integrity programs, or management of change programs/processes.

f. Personal Protective Equipment - equipment worn by individuals to reduce exposure to the hazard (e.g., NIOSH).

e) A description of any Management of Change systems (if applicable) in place at the facility that are used to manage risks related to design changes and modifications to equipment, procedures, and organization.

f) A description of any devices, systems, or actions (i.e. collectively known as the Layers of Protection) designed to reduce the likelihood and severity of any undesired events or hazard scenarios. This could include a description of the basic hazard controls, process alarms and operator supervision procedures in place as well as a discussion on the preventative and mitigative barriers/safeguards in place. Preventative and mitigative barriers are defined as (adopted from AICHE CCPS Glossary):

a. Preventive Barrier - A barrier designed to interrupt the chain of events leading up to a loss event, given that an initiating event has occurred. Note: Specific to the hazards evaluation of an incident sequence, a preventive barrier is located/occurs between the initiating event (the cause) and a loss event (the effect), helping reduce the frequency of the incident scenario, and thus, helping reduce the scenario's risk. Examples of these include critical alarms, operator supervision, manual intervention, automatic action safety instrumented systems (SIS), emergency shutdown devices, and physical protection relief devices.

b. Mitigative Barrier - A barrier designed to interrupt the chain of events after a loss event, given that there has been a loss of containment of a hazardous substance or energy. Note: Specific to a hazards evaluation of an incident sequence, a mitigative barrier is located/occurs between the loss of event (the loss of containment) and the scenario's impact, helping reduce the consequences of the incident scenario, and thus, helping reduce the scenario's risk. Examples of these include physical protection devices (dikes), plant emergency response and community response.

Inherent Safety in Action

Using the concept of inherent safety, some facilities have:

- Replaced tanks with others that have a capacity that is below the threshold limit, precluding them from E2 reporting;
- Substituted an E2 regulated substance for one that is less hazardous so that they are no longer subject to the E2 Regulations; and
- Separated connected containers by remote valves which eliminated the obligation to prepare an E2 Plan.

5.3.7 Preparedness

Regulatory Aspects Addressed in the Preparedness Section

4(2)(g)a description of the measures to be taken to prevent and prepare for the environmental emergencies identified under paragraph (d) and the measures that will be taken to respond to and recover from such emergencies if they were to occur

4(2)(h) a list of the position titles of the persons who will make decisions and take a leadership role in the event of an environmental emergency and a description of their roles and responsibilities

4(2)(k) a description of the measures that will be taken by a responsible person or by a responsible person and local authorities, acting jointly, to communicate with the members of the public who may be adversely affected by the environmental emergency referred to in paragraph (f) to inform them, before the environmental emergency occurs, of:

- *(i) the possibility that the environmental emergency could occur,*
- *(ii) the potential effects of the environmental emergency on the environment and on human life or health, taking into account the factors referred to in paragraphs (a) to (c), and*
- *(iii) the measures that will be taken by the responsible person to protect the environment and human life or health, and the means by which the responsible person will communicate with them, in the event that the environmental emergency occurs*

4(2)(i) a list of the environmental emergency training that has been or will be provided to prepare personnel at the facility who will respond in the event that an environmental emergency identified under paragraph (d) occurs

4(2)(m) the position title of the person who will communicate with the members of the public referred to in paragraphs (k) and (l)

4(2)(n) a description of the consultations that a responsible person had with local authorities, if any, with respect to the measures referred to in paragraphs (k) and (l)

4(4) The measures included in the environmental emergency plan must be adequate to address the objectives of preventing, preparing for, responding to and recovering from the environmental emergencies identified under paragraph (2)(d)

Regulatory Aspects Addressed in the Preparedness Section (Cont')

7(1) A responsible person must conduct simulation exercises in relation to each environmental emergency plan that is prepared under subsection 4(1) as follows:

(a) each year, beginning on the day on which the plan is brought into effect, a simulation exercise in respect of one substance from each of the hazard categories referred to in column 5 of Parts 1 and 2 of Schedule 1, using an environmental emergency identified under paragraph 4(2)(d) as the emergency being simulated; and

(b) every five years, beginning on the day on which the plan is brought into effect, a full-scale simulation exercise in respect of any one substance, using an environmental emergency referred to in paragraph 4(2)(e) or (f) as the emergency being simulated

8 After each simulation exercise is conducted in relation to the environmental emergency plan, a responsible person must prepare a record that contains the date, a summary and the results of the simulation exercise and any modifications to be made to the plan as a result of the simulation exercise.

Preparedness measures identify all activities essential to ensuring a high degree of readiness for a prompt and effective response to an environmental emergency. Testing the preparedness of a facility's resources and equipment to manage and reduce the severity of such events can be achieved through exercises and focused training for key personnel who are tasked with responding to environmental emergencies at a facility. Equipment needed during an emergency must be readily available and regularly inspected, tested and maintained. An inventory of equipment currently available on and off site, along with the quantity and location, must be included in the plan and made accessible to responders.

This section of the E2 Plan must provide a description of the preparedness aspects for the identified scenarios. The following list is of examples is not exhaustive: The responsible person must implement the measures that are best suited for their facility.

a) *Incident Management System

A description of the overall Incident Management System (i.e. Incident Command System) used to direct, control, and coordinate response and recovery operations. A chart showing the incident command organization structure could also be included in the plan, if applicable.

b) Roles/Responsibilities – 4(2)(h)

A list of the position titles of the persons (responders and senior management) who will make decisions and take a leadership role in the event of an environmental

emergency, and a description of their roles and responsibilities. Ideally, this would include a description of the lines of authority and the identification of any designated alternates. The plan should also identify and describe the roles and responsibilities of any outside response organizations/contractors and other agencies who have specific responsibility under the plan. To ensure external agencies and response organizations who have agreed to the roles/relationships outlined in the plan, it may be necessary to develop mutual aid/mutual assistance agreements with those organizations.

An organization chart that outlines key positions, duties and reporting relationships could be included in this section. It is also suggested that an internal contact list that identifies the 24 hour telephone numbers for activating the E2 Plan, and the home/office phone numbers for the Incident Commander, key Incident Management Personnel, local management and, if applicable, the regional or national company management be included in this section.

c) Advance Public Notification/Communications – 4(2)(k) & (m)

Advance public notification is required for each alternate worst-case scenario identified in the E2 Plan. It must occur after the E2 Plan has been brought into effect, but before there is any chance of the scenario(s) occurring. If a facility does not have an alternate worst-case scenario for any substance identified in their E2 Plan, they are not required to perform advance public notification.

The extent of the public to be notified is determined by the impact distance of the alternate worst-case scenario. It must also take into consideration the tenants of any leased property, property access rights provided to third parties, and any potentially impacted transportation corridors. Notification of employees or other individuals (visitors, etc.) within the facility boundaries must also be taken into consideration if it is not addressed elsewhere, such as through occupational health and safety legislation. This might be dependent on site specific circumstances and could be clarified with local authorities if necessary. Decisions as to any exclusions should be well documented in the E2 Plan.

The responsible person must use their professional judgement to select the most effective methods of communication, based on site specific circumstances. This may include, but is not limited to: public meetings / information sessions, flyers, posters, stickers, website, newsletters, open house meetings, online consultations, safety day, information booths at events, door-to-door direct contact, partnering with a local Community Awareness and Emergency Response group or involving the public in exercises. Provincial legislation/directives may be available to guide communication efforts.

Information to be provided, before an emergency occurs, must include:

- The possibility that an environmental emergency that could have an impact outside the boundary of the facility could occur;

- The potential consequences of the environmental emergency;
- The measures that will be taken in the event that the environmental emergency occurs; and
- The method(s) that the facility will use to communicate with members of the public during an emergency.

This section of the E2 Plan must include the position title of the person(s) who will speak on behalf of the facility/responsible person to communicate the information, e.g., Public Relations Officer. It should also include the outcomes of any consultations with local authorities.

Requirements for the public notification/communications that must occur during and after an environmental emergency are referenced in the "Response" Section of this document (5.3.8)

d) External Alerting and Notification

Although not explicitly regulated, Section 4(4) of the E2 Regulations (Adequate Measures) implies that the E2 Plan must describe how external Public Safety Authorities (Fire, EHS, Police, etc.), news media, and off-duty workers will be contacted during working and non-working hours in the event of an emergency. It is recommended preparedness planning for communities is done as a joint effort with local authorities.

e) Evacuation/Shelter in Place – 4(2)(l)

If applicable, this section of the E2 Plan must include a description of the elements to be considered as part of the evacuation or shelter-in-place plan. This may include, but is not limited to:

- A description of the notification/alarm system;
- Maps showing both the primary and alternate evacuation routes (if applicable) – these may be scenario dependant;
- A description of the key muster stations and/or assembly areas (primary and alternate) in the event of an evacuation;
- The name or title of the person responsible for checking the evacuation area in the event an evacuation order is issued and for taking personnel counts at the assembly area to ensure that the area has been safely evacuated;
- A description of any emergency escape equipment/vehicles and their location (if applicable);

- A description of the process to be utilized during the emergency phase to provide air dispersion estimates (and updates) for toxic releases to better define the evacuation zones or shelter-in-place zones;
- A description of the procedures to expand extent of the evacuation or shelter-in-place zones if the emergency situation escalate; and
- A description of the procedures for those sheltered-in-place to exit sheltered areas or evacuees to return once the "all clear" command has been issued.

f) *Mutual Aid/Mutual Assistance

A regulated facility may exercise its E2 Plan jointly with other facilities as part of a mutual-aid agreement as long as the facility is the main player in the exercise (i.e., where the E2 exercise will potentially be applied as a response to an incident) and the exercise takes place at its own property with active involvement of its own employees in the simulation of a scenario identified in its E2 Plan. The exercise must also meet all the requirements of the E2 Regulations if the intention is that the exercise(s) will satisfy their regulatory obligations.

This section of the plan must identify any external organizations covered under a Mutual Aid/Mutual Assistance agreement and describe the lines of authority for external agencies. It must also identify if the entire E2 Plan or just applicable sections of the plans will be made available to those assigned specific tasks and responsibilities under the Mutual Aid/Mutual Assistance agreement. It is important to note that any other facilities taking part in the exercise(s) will not be satisfying any of their regulatory requirements with respect to exercises.

g) Equipment – 4(2)(j)

This section of the E2 Plan must contain a description of all applicable emergency response equipment, including quantities and location. The description of the location of numerous pieces of the same equipment need not necessarily be explicit. It could simply consist of a map, schematic diagram that showcases key stockpiles of equipment such has fire extinguishes or spill kits, or general references, e.g., "50 fire extinguishers onsite, each located within XX feet of each processing area". The methodology that can best meet the needs of the regulations is up to the discretion of the responsible person.

As implied by Section 4(4) of the E2 Regulations (Adequate Measures), any response equipment must be readily accessible in the event of the environmental emergency scenarios that have been identified for the substances at a facility. The equipment must also be ready to use and properly maintained.

It is also recommended that a description of the procedures to inspect, test and maintain the integrity of the emergency response equipment be included in the E2 Plan.

h) *Contact List/Resource Lists

This section of the E2 Plan could also be included in an Appendix or at the beginning of the plan. It should include a description of the sources of local assistance including telephone numbers and Position/Names of contacts for the following, as applicable:

- Fire Departments;
- Police;
- Municipal Emergency Measures Organizations (EMO)
- Hospitals;
- EHS (Ambulance);
- Municipal/Provincial/Federal Agencies;
- Industry assistance contacts;
- Local clean-up contractors;
- Response Organizations or Response Co-operatives;
- Mutual Aid/Mutual Assistance Organizations;
- Response equipment and material suppliers;
- Government assistance contacts (i.e. CANUTEC);
- Security; and
- Media

i) Training – 4(2)(i)

The facility is responsible for ensuring the readiness and expertise of their personnel required to activate the E2 Plan. This section of the E2 Plan must include a list of the training that has been, or will be provided, to the personnel at the facility who will respond in the event that an environmental emergency occurs. A record of all completed training by employees should be maintained at the facility, and be readily available.

*It is also recommended that a training curriculum is developed for all staff including incident management personnel, facility staff, contractors, response organizations, and mutual aid/mutual assistance agencies that could be involved in responding to an emergency. This could include a description of the training program elements including:

i. commitment from senior management that all staff involved with managing or responding to emergencies will be sufficiently trained to be thoroughly familiar with company policy and procedures for the prevention of, the preparedness for, the response to, and recovery from emergencies;

ii. identification of training requirements in terms of type, amount and frequency for key personnel depending on their roles/responsibilities under the E2 Plan;

iii. procedures for reviewing and updating the training curriculum; and

iv. any training offered to external agencies that may be involved in the response such as Fire, Police, Emergency Health Services (EHS), or local municipal Emergency Management Organization (EMO) staff.

*In addition, training should be provided to key personnel on a regular basis and when changes occur such as:

- new employees are hired;
- there is a change in staff duties;
- new equipment, processes or hazardous substances are introduced;
- new emergency procedures are developed;
- changes to the training curriculum; and
- following exercises when improvements/updates are made to the E2 Plan.

j) Environmental Emergency Simulation Exercises – 7(1) & 7(2)

The E2 Regulations require that E2 Plans be exercised every year with respect to one substance from each of the applicable hazard categories. A full-scale exercise must be carried out every five years with respect to any one substance using the alternative worst-case scenario or the worst-case scenario.

*Although not prescribed by the E2 Regulations, it is recommended that this section of the E2 Plan: describe the emergency exercise program; identify the simulation exercises to be carried out including number, type, and frequency; and include a description of the mechanism to document and implement lessons learned from emergency response exercises. The specific requirements for simulation exercises can be found in Section 6 of this document.

*The responsible person is also required to keep a record of the results of these annual and full-scale simulation exercises including: the date and summary of the exercise, the results of the exercise, and any modifications made to the plan as a result. It is recommended that an Appendix be placed within the E2 Plan to record this information so it can be presented for inspection upon request. Other methods of records management are also acceptable, provided the records can be easily presented upon request under any circumstances.

5.3.8 Response

Regulatory Aspects Addressed in the Response Section

4(2)(g)a description of the measures to be taken to prevent and prepare for the environmental emergencies identified under paragraph (d) and the measures that will be taken to respond to and recover from such emergencies if they were to occur

4(2)(l) a description of the measures that will be taken by a responsible person or by a responsible person and local authorities, acting jointly, to, in the event that an environmental emergency involving the release of a substance occurs, communicate with the members of the public who may be adversely affected to provide them, during and after its occurrence, with information and guidance concerning the actions that could be taken by them to reduce the potential harm to the environment and danger to human life or health, including an explanation of how those actions may help to reduce the harm or danger

4(2)(m) the position title of the person who will communicate with the members of the public referred to in paragraphs (k) and (l)

4(2)(j) a list of the emergency response equipment that is necessary for the measures described in paragraph (g) and the equipment's location;

4(4) The measures included in the environmental emergency plan must be adequate to address the objectives of preventing, preparing for, responding to and recovering from the environmental emergencies identified under paragraph (2)(d)

18(1) For the purposes of these Regulations, paragraph 201(1)(a) of the Act applies only in relation to an environmental emergency that (a) has or may have an immediate or long-term harmful effect on the environment; (b) constitutes or may constitute a danger to the environment on which human life depends; or (c) constitutes or may constitute a danger in Canada to human life or health.

18(2) The person who is designated to be provided with a written report respecting the occurrence of an environmental emergency involving a substance that is on the list referred to in section 2 is the Regional Director, Environmental Enforcement Directorate, Enforcement Branch, Department of the Environment, in the region where the environmental emergency occurs.

18(3) The written report must include the information referred to in Schedule 8

Response to an environmental emergency is intended to include all aspects of managing the emergency situation until the emergency phase of the event is considered over. These needs can vary greatly in scope, depending on the nature and magnitude of the emergency.

Effective emergency response includes, but is not limited to, the following:

- Quick activation of the emergency plan;
- Adequate resource mobilization;
- Rapid assessment of the probable path and impacts of the emergency;
- Proper notification of the emergency to first responders and affected parties, including alerting and warning the public;
- Maintenance of communication systems between stakeholders;
- Evacuating, confining (i.e. shelter-in-place) and accounting for personnel and members of the public present at a facility's site, if needed; and
- Adequate reporting.

This section of the E2 Plan must provide a description of measures to be taken to respond to the environmental emergency scenarios identified in the E2 Plan. The following list of examples is not exhaustive. It is incumbent on the responsible person to exercise their professional judgement to determine the response measures for their facility and ensure that the E2 regulatory requirements are met.

a) *Incident Classification

If applicable, the response plan should describe the emergency evaluation and classification system. Emergencies may be categorized in various levels. For example:

- Level I: minor release requiring an on-site staff to respond and take necessary actions
- Level II: intermediate level release requiring response by on-site or off-site trained staff but posing no potential harm to the environment and danger to human life or health outside of the facility boundaries.
- Level III: a major incident beyond the resources of the facility or an incident with the potential to harm the environment and human life or health.

This section of the plan should also summarize the main roles and responsibilities for key personnel based on the various categories of emergency (i.e. level I, level II, level II, etc.). The plan should include a description of the process to evaluation and escalate the response level from one to another, if warranted. It is recommended that the roles/responsibilities and lines of authority for decision

making for each emergency category is clearly shown in an organization chart.

b) Plan Activation – 4(2)(h) and 4(4)

Detecting of an incident, assessing the information (including incident classification) and implementing initial action decisions are the first steps in responding to an emergency incident. The E2 Plan must include a description of:

- The procedures for processing emergency notifications and/or alerts received from on-site alerting systems or from sources outside the facility boundaries (i.e. off-site air monitoring stations, the public, public safety authorities, media, etc.) upon the detection of an incident.
- Personnel having on-scene authority to evaluate the situation based upon the alert/notification, assess the magnitude of the issue and activate the emergency plan.
- How initial incident assessment information is to be relayed to the incident management team.

It is recommended that an Emergency Action Checklist that highlights the key initial steps from incident detection to response plan activation including any subsequent notification/reporting aspects be developed and included in the E2 Plan. All activation procedures should be operational 24 hours per day/7 days a week and all applicable telephone numbers included on a plan activation contact list.

c) *Incident Management

The response plan should identify how the facility transitions from normal operations to emergency operations. If applicable, this section of the E2 Plan should describe how the incident management system and any associated command centres are established during an emergency. This may be part of an Incident Command System or any other method in use, as determined by the responsible person.

During emergencies, response operations may be directed primarily out of an Emergency Operations Centre (EOC) and/or Incident Command Post (ICP). An ICP is typically the field location established at the time of the emergency from which to coordinate and direct all tactical response and mitigation efforts within an established perimeter. The EOC typically manages all issues related to the emergency outside the perimeter established by the ICP and provides support to the ICP.

A map of the location of the Emergency Operations Centre (EOC), as well as

alternate locations should be included in the E2 Plan. Incident Command Post(s) should be located a safe distance away from the incident itself so as not be subject to the threats associated with the emergency.

d) Emergency Notification/Communications – 4(2)(l)

As part of the development of the E2 Plan and its implementation, the responsible person is required to describe the public notification initiatives that will be undertaken to provide accurate and up to date information to all individuals who may be adversely impacted by the environmental emergencies identified in the E2 Plan. This includes providing notification of an emergency, and giving timely updates during and after the emergency.

Notification of employees or other individuals (visitors, etc.) within the facility boundaries must also be taken into consideration if it is not addressed elsewhere, such as through occupational health and safety legislation. This might be dependent on site specific circumstances and could be clarified with local authorities if necessary. Decisions as to any exclusions should be well documented in the E2 Plan.

This section of the plan must provide a description of the emergency notification system (i.e. alarms, lights, signs, instructions, messages, etc.) that will be utilized (both internally and externally) to warn, alert or notify facility personnel, management, first responders, regulatory authorities, industrial neighbours, the potentially affected public, and other external stakeholders as needed in the event of the an emergency. It must also identify the position title of the person(s) who will communicate with the members of the public (This information may have already been gathered for the section on “Communications” in the Prevention Portion of the E2 Plan.)

Information to be provided in the description of the communication measures taken during and after an emergency must include:

- whether or not the responsible person will be acting jointly with a local authority;
- identification of any local authorities (if applicable);
- how the public will be notified of actions that they may have to undertake in order to reduce/eliminate the potential harm resulting from the emergency (e.g., evacuation or shelter in place); and
- an explanation of how those actions may help to reduce the harm or danger.

Once the environmental emergency has been resolved, members of the public should be notified as soon as possible. Communications regarding damage

assessment, investigation, and potential compensation should also be included in a “post-event” notification.

It is recommended that all emergency notification/alerting system activation procedures (both internal and external) be operational 24 hours per day and all applicable contact numbers included on an emergency notification contact list. The list should include the names/positions of any backup or alternate emergency response personnel or Incident Management Team members.

It is also recommended that the facility develop an Emergency Incident Report form that contains information consistent with the requirements as outlined in Schedule 8 of the E2 Regulations.

e) *Communication Systems

This section of the E2 Plan should describe the types of communication systems or equipment (i.e. cell telephones, public address systems, two-way radios, etc.) to be used by personnel during an emergency response. It is also recommended that the type of communication equipment utilized by external responders is verified before they arrive on-site to ensure that it is compatible with the facility communication system and equipment. In the event the equipment is not compatible, a procedure should be developed so that common communication equipment can be shared amongst all responders associated with the emergency response to ensure they can communicate effectively.

The E2 Plan should also include procedures for the use, maintenance, and testing of communication systems. The types of communication systems used by key external response support agencies (Fire, Response organizations, contractors, etc.) should also be considered during facility communication systems testing.

Since normal means of communication can break down in an emergency, alternative methods of communication (e.g., amateur radio, messengers, etc.) should also be considered.

f) Emergency Response Measures

This section of the E2 Plan must identify the emergency response measures that will be taken to manage the environmental emergency scenarios identified in the E2 Plan. This will include any relevant emergency response procedures and/or standard operating procedures (SOPs) related to specific aspects of those emergencies. Where similar aspects exist between multiple scenarios, it is understood that common plans may be developed for very similar incident responses. For example, a SOP on communications or emergency evacuation might be applicable to more than one scenario.

The detailed specific response procedures need not be included in the E2 Plan,

but a reference to their title and location must be identified. If a decision is made to include the SOPs in the E2 Plan, they should be placed in the appendices. It is incumbent on the responsible person to use their professional judgement to determine which emergency response procedures should be prepared for their facility. "Examples of emergency response procedures, and/or standard operating procedures (as adapted from the CSA Z767 PSM Standard), include, but are not limited to the following:"

a. Emergency plan activation and deactivation procedures;
b. Release trajectory prediction and monitoring (include tracking updates)
c. Location and inventory of the required response equipment;
d. Procedures to establish safety perimeters and site controls;
e. External emergency notification procedures;
f. Evacuation procedures and emergency escape route details including assembly instructions and locations of assembly points (e.g., muster stations);
g. Procedures to account for all personnel after an emergency evacuation has been initiated;
h. Fire suppression;
i. Spill control and containment procedures;
j. Clean up and recovery procedures;
k. Procedures to put facility into a safe state, e.g., emergency shutdown;
l. Procedures to take a facility/process from an idle, at-rest state (i.e. due to emergency shutdown, temporary hibernation) to normal operation due to the fact that start-up and shutdown periods may involve many non-routine procedures, and these periods can result in unexpected and/or unusual situations.
m. Identification of other credible threats to process and storage systems;
n. Identification of any mutual aid agreements activation procedures;
o. Procedure for identifying and accounting for personnel engaged in response activities;
p. Procedures to be followed by personnel who remain to operate critical plant systems before they evacuate;
q. Procedures on the means for identification of organization personnel at the incident boundary so that they could become part of the response effort;

r. Procedures for the identification and granting access to first aiders, medical personnel, medical equipment, and medicines required to deal with the identified hazardous scenarios; and

s. Procedures for site access during and after the emergency.

5.3.9 Recovery/Restoration

Regulatory Aspects Addressed in the Recovery Section

4(2)(g) a description of the measures to be taken to prevent and prepare for the environmental emergencies identified under paragraph (d) and the measures that will be taken to respond to and recover from such emergencies if they were to occur

4(2)(l) a description of the measures that will be taken by a responsible person or by a responsible person and local authorities, acting jointly, to, in the event that an environmental emergency involving the release of a substance occurs, communicate with the members of the public who may be adversely affected to provide them, during and after its occurrence, with information and guidance concerning the actions that could be taken by them to reduce the potential harm to the environment and danger to human life or health, including an explanation of how those actions may help to reduce the harm or danger

4(2)(m) the position title of the person who will communicate with the members of the public referred to in paragraphs (k) and (l)

4(2)(j) a list of the emergency response equipment that is necessary for the measures described in paragraph (g) and the equipment's location

4(4) The measures included in the environmental emergency plan must be adequate to address the objectives of preventing, preparing for, responding to and recovering from the environmental emergencies identified under paragraph (2)(d)

Recovery from an environmental emergency is more than just the recovery of the released substance. Recovery refers to the restoration of any part of the environment damaged by or during the emergency. It affects both the operating entity and the surrounding community. The level of environmental restoration is determined by many factors, such as the size, persistence, toxicity, or hazardous nature of a release. Recovery of an area to its natural state is not always possible. Restoration plans are situation-

specific and need to be defined in terms of acceptability to affected stakeholders.

This section of the E2 Plan must include a description of the measures to be taken to recover from the identified environmental emergency scenarios. This typically includes damage assessment and site rehabilitation procedures that address restoration aspects. The following list of examples is not exhaustive. The responsible person must determine the measures that are best suited for their facility.

a) Disposal/Waste management – where applicable, the development of disposal/waste management procedures in advance of an actual incident must be done in consideration of the potential impacts associated with the list of scenarios developed for the E2 Plan

b) Site Restoration – where applicable, development of site restoration procedures in advance of an actual incident must be done in consideration of the potential impacts associated with the list of environmental emergency scenarios developed.

c) Public notification - In accordance with Section 4 (2)(l) of the E2 Regulations, messaging for external stakeholders, this must include a description of the actions to be taken by the facility to reduce the potential harm to the environment and danger to human life or health, including an explanation of how those actions may help to reduce the harm or danger.

d) *Stakeholder Engagement – the issue of recovery is best managed through discussions amongst all stakeholders to assess the damage and agree on a restoration plan

e) *Post Incident Investigation and Evaluation – process that might include the following elements:

- Conducting an incident investigation to identify the cause or initiating event of the incident;
- Preserving evidence that may aid in the incident investigation;
- Conducting a review and debrief on the emergency response procedures and resources activated during the response;
- Incorporating lessons learned into the E2 Plan

Contractor Services

If a facility hires a contractor to provide emergency response services, the facility remains responsible for compliance with the E2 Regulations

5.3.10 Appendices and Operational Guidelines

Appendices are often used to provide reference to information that is too lengthy for the text, or for ease of use. The inclusion of appendices in the E2 Plan is not mandatory. The following is provided for information purposes only. The types of documents that might be included in E2 Plan appendices include, but are not limited to, the following:

Contact Lists

- E2 Plan Development Committee member list
- Incident Management Team and key response personnel call out list
- Internal Public Relations Officer/Communication Officer contact List
- Resources Agencies contact list
- Government agencies contact list
- Public Safety Authority contact list
- Community residents contact list
- Waste Disposal Companies contact lists
- Response Organizations/Response contractors/Cleanup contractors contact lists
- E2 Plan distribution list
- Weather information contacts

Documentation

- Substance list
- Incident Management Team/Incident Command Organizational Charts
- Emergency Incident Report forms
- Monitoring procedures (air emissions, land, water quality)
- Applicable Legislations (i.e. E2 Regulations, etc.)
- Decontamination procedures
- Safety Data Sheets
- Reference Publications

Dynamic Records

- Training Records
- Exercise Records
- Equipment inspection, testing and maintenance schedules
- Emergency equipment list (both on-site and off-site) & shelf-life

Maps/Diagrams

- Emergency evacuation plan and escape routes
- Shelter-in-Place Procedures
- Facility maps, Process diagrams, P&ID drawings
- Charts

5.4 Other considerations for the development of an E2 Plan

5.4.1 Deadlines for Preparing and Implementing an E2 Plan

An E2 Plan must be prepared when a regulated substance onsite:

- Meets or exceeds the concentration criteria in Schedule 1;
- Meets or exceeds the quantity threshold in schedule 1; and
- Meets or exceeds the criteria for container system capacity in Schedule 1 (if the substance is contained.

The deadlines in table 4 apply starting from the date the above criteria are met. Activities may also be undertaken in advance of the prescribed deadline, or more often than the requirements identified in the E2 Regulations (as applicable).

Table 4. Timelines for E2 Plan Preparation and Implementation

Aspect of the E2 Regulations	**Timeline**	**Location of notice in the E2 Regulations to be submitted to ECCC**
An E2 Plan must be prepared	Within 6 months	Schedule 3
Public notification must occur	Before or on the day that the E2 Plan is brought into effect	NA
An E2 Plan must be brought into effect	Within 12 months	Schedule 4
Simulation exercises must be conducted	Annually, with scenarios associated with each hazard category in the E2 Plan, beginning after the E2 Plan has been brought into effect	Schedule 5 (not to be submitted until ***after*** the full scale exercise has been completed)
A full scale exercise must take place	Once every five years, beginning after the E2 Plan has been brought into effect	Schedule 5
An E2 Plan must be reviewed	Annually, at minimum	N/A but record of review must be kept for seven years
An E2 Plan must be updated	As required changes are identified	N/A

5.4.2 Existing plan

> "A lot of people talk about expecting the best but preparing for the worst, but I think that's a seductively misleading concept. There's never just one "worst." Almost always there's a whole spectrum of bad possibilities. The only thing that would really qualify as the worst would be not having a plan for how to cope."
>
> - Chris Hadfield (An Astronaut's Guide to Life on Earth, p. 69)

In order to prevent duplication of effort, subsection 4(3) of the E2 Regulations allows facilities to use an existing environmental emergency plan that has been prepared on a voluntary basis for another government body or under another act of Parliament. Where such a plan does not meet all the requirements identified within the E2 Regulations, the plan must be amended to meet the remainder of those requirements. It is also possible for regulatees to use old E2 Plans prepared under the previous regulations. However, as some requirements have changed, facilities must verify that the old E2 Plan satisfies all the requirements of the current E2 Regulations. Although not specified in the E2 Regulations, it is good practice to consolidate (or at least directly reference) all elements of the E2 Plan in a single dossier.

5.4.3 Location of E2 Plan documentation

In order to comply with section 11 of the E2 Regulations, the responsible person must keep the E2 Plan readily available at the facility for the individuals who are responsible to execute the plan, as well as at any other location where the plan may need to be consulted by these individuals. Components of the E2 Plan can be located within multiple binders or files. Electronic file storage may also be acceptable under certain circumstances.

The decision as to where to store documentation rests with the responsible person, who must ensure that all of the information that completes the E2 Plan is accessible to those that are required to carry out the plan, under any circumstances, ***regardless of whether or not the individuals are able to access functioning electronic devices.***

5.4.4 Annual Review of the E2 Plan

An E2 Plan must be reviewed annually at minimum, and updated as necessary to ensure that it incorporates any changes within the facility; or any required modifications that were identified through simulation exercises or actual incidents. The annual review involves

more than checking telephone numbers. It must consider any changes at the facility and surrounding area that could impact potential hazards and risk. This includes, but is not limited to:

- Changes in the substances onsite
- Changes in the delivery, storage or processing of substances;
- Updates to the management system, (if applicable);
- Any new level of toxicity hazard;
- Changes to the receptors in the surrounding area;
- Results of new or updated impact analysis (if required);
- Any new development in software used;
- Updates to emergency response procedures and/or SOPs; and
- Administrative changes.

The applicable public must be informed of any significant updates when they are relevant to the protective actions they should take in the event of an emergency. Additional advance notification will also be required if the impact distance of the alternate worst-case scenario has increased.

A record of the review and the date it was reviewed must be maintained for at least seven years beginning on the day the record is made. The updated E2 Plan must be readily available in the event of any type of emergency.

6.0 Simulation Exercises

Environmental emergency exercises involve a simulation relating to an emergency scenario that has been identified in the E2 Plan. Exercising the E2 Plan provides those who are responsible for the facility with valuable information regarding their readiness and ability to respond to one or multiple elements of an environmental emergency.

The E2 Regulations require that E2 Plans be exercised on an annual basis. A full-scale exercise must also be conducted every five years. Based on the outcome of these exercises, the E2 plans must be reviewed and updated, as required. The responsible person is required to keep a record of these annual and full-scale simulation exercises, including the date, a summary of the exercise, the results of the exercise, and any modifications made to the plan as a result.

ECCC recommends that an appropriate exercise design process be composed of the following four main steps:

1. Planning the annual exercise(s);
2. Conducting the exercise(s);
3. Evaluating and reporting on the outcomes; and
4. Updating the E2 Plan(s) with lessons learned.

The main objective is to ensure that all aspects of the E2 Plan are fully evaluated over the five-year testing cycle. Further information on exercising emergency response plans can be found in some of the suggested references in Appendix 6. Guidance on performing exercises with mixtures can be found in Appendix 2 of this document.

6.1 Annual Simulation Exercises

The following section details the requirements of Section 7(1)(a) of the E2 Regulations and does not pertain to the full scale exercise that must be conducted once every five years. Information on full scale exercises can be found in section 6.2 of this document.

Simulation exercises may take many forms. The responsible person must exercise their professional judgement to determine which types of exercises are best suited for their facility. They should also take into consideration any lessons learned from previous exercises. Factors to be taken into account include, but are not limited to: the purpose of the exercise, the time of year, the availability of resources, and any site specific or operational limitations. Examples of simulation exercises include the following:

- ***Drills*** are supervised activities that provide the opportunity for emergency response team members to validate a specific operation or function, usually focused on one or two key skills (e.g., shutdown procedures, valve operation, etc.).

They can also be used to: determine whether plans can be executed as designed, assess whether more training is required, or reinforce best practices.

- ***Tabletop*** exercises are table-based activities typically held in an informal setting and presented by a facilitator. This type of exercise is intended to generate discussion of various issues regarding a hypothetical, simulated emergency. Tabletop exercises can be used to enhance general awareness of sensitive areas, validate plans and procedures, rehearse concepts and, assess the types of systems needed to guide the prevention of, preparedness for, response to and recovery from a defined incident.

- ***Functional*** exercises fall between a tabletop exercise and a full-scale exercise. They are more involved than a tabletop exercise where participants only discuss what they might do, but less intensive than a full-scale exercise, where resources are actually deployed as necessary. In a functional exercise, the Command Post Team "takes action"—makes decisions, simulates the deployment of resources and responds to new developments. A functional exercise provides a more realistic simulation of an emergency compared to a tabletop and is typically conducted in real time in a classroom setting or a designated site for a Command Post. Functional exercises should include outside partners, as applicable, in order to evaluate response times.

It is recommended that key response personnel/stakeholders identified in the E2 Plan be involved in discussions during the planning stage of the simulation exercises, where applicable. Their involvement will reinforce their role in the E2 Plan and enable the responders and other participants to react in the proper manner through adequate pre-planning. However, once sufficient skills and knowledge have been acquired, it is recommended that the scenarios be developed without the participants' prior knowledge, to simulate a more realistic situation.

Section 7 of the E2 Regulations requires that annual simulation exercises be conducted in relation to the E2 Plan prepared for the facility. The exercise(s) must:

- Involve at least one regulated substance identified in the E2 Plan from each of the hazard categories referred to in column 5 of Parts 1 and 2 of Schedule 1 in the E2 Regulations;
- Make use of an environmental emergency identified in the E2 Plan; and
- Cycle through the environmental emergency scenarios identified in the E2 Plan until such a time that they have all been exercised.

Hazard categories for each regulated substance are listed in column 5 of Schedule 1 of the E2 Regulations. They consist of:

- aquatically toxic (A)
- combustible (C)
- explosion hazard (E)
- pool fire hazard (F)
- inhalation hazard (I)
- oxidizer that may explode (O)

If a facility's E2 Plan is developed for a single substance that is associated with one hazard category only, then a single environmental emergency scenario from the E2 Plan must be simulated each year until all of the identified scenarios have been cycled through. At that point, the cycle would start again.

If a facility has three regulated substances onsite, all of which are associated with different hazard classes, then an emergency scenario for each substance must be simulated each year until all of the scenarios have been cycled through. At that point the rotation would begin again.

Details on how a facility can plan their simulation exercises for more complex scenarios are identified in the following section.

6.1.2 Cycle for annual simulation exercises

The process of determining how to schedule annual simulation exercises can be broken down into four tasks:

1. Identify the substance(s) and hazard categories
2. Group the substances by hazard category
3. Identify the associated environmental emergencies in the E2 Plan
4. Select one scenario to exercise ***per hazard category*** each year, using a different one each year (except the year a full-scale exercise is performed), until all of the identified scenarios are exercised.

The following examples are for demonstration purposes only. It is incumbent on the responsible person to develop an exercise schedule that meets the requirements outlined in the E2 Regulations.

Example A – Multiple substances, same hazard category

Site A stores petroleum crude oil and diesel fuel onsite. The concentration and quantity thresholds in Schedule 1 of the E2 Regulations are exceeded for both substances, which are identified as being Pool Fire Hazards. The facility's E2 Plan identifies three environmental emergency scenarios for each substance – worst-case (WC), alternate worst-case (AWC), and a third scenario, C. Details are summarized below:

Substance Number	Substance	Hazard Category	Emergency Scenario
1	Petroleum Crude Oil	F	WC1, AWC1, C1
2	Fuels, diesel	F	WC2, AWC2, C2

Because all of the substance are from the same hazard category, only one simulation exercise is required annually. Once all six identified scenarios have been exercised, the cycle must begin again. The following exercise schedule is an example that would meet the regulatory requirements:

Hazard Exercised	**Year**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
F	Exercise	WC1	AWC2	C1	WC2	*Full Scale	AWC1	C2	Start from beginning

*A full-scale exercise is required every five years. Additional details can be found in the next section of this document.

Example B – Three substances, three different hazard categories

Site B stores propane, anhydrous ammonia and unleaded gasoline on-site. All four substances are stored at quantities and concentrations above the thresholds set out in Schedule 1 of the E2 Regulations. The E2 Plan identifies 12 emergency scenarios. Each substance has worst-case (WC) and alternate worst-case (AWC) scenario, and alternate scenarios ranging from C to E. Details are summarized below:

Substance Number	**Substance**	**Hazard Category**	**Emergency Scenario**
1	Propane	E	WC1, AWC1, C1
2	Anhydrous Ammonia	I	WC2, AWC2, C2, D2
3	Unleaded Gasoline	C	WC3, AWC3, C3, D3, E3

In total, three hazard categories need to be exercised annually (E, I, and C), and a total of 12 scenarios exercised over time. Because there are a number of substances, all with different hazard categories, and differing numbers of environmental emergency scenarios, the cycle for simulation exercises will be different for each substance. As a result, they will be unevenly staggered over the years. An example of a schedule that would meet regulatory requirements is below. Please note that a reference to a year number means to repeat the exercise for that substance in that particular year.

Hazard Exercised	**Year**	**1**	**2**	**3**	**4**	**5**	**6**	7	**8**
E **I** **C**	Exercise	WC1 D2 AWC3	AWC1 C2 E3	C1 WC2 D3	WC1 AWC2 C3	Full Scale	AWC1 Year 1 WC3	C1 Year 2 Year 1	Year 1 Year 3 Year 2

Example C – Six substances, four hazard categories

Site C stores methane, acetylene, nitric acid, ammonium nitrate, Fuel Oil, No.4, Fuel Oil No.2, and cadmium chloride on-site. All seven substances are stored at quantities and concentrations above the thresholds set out in Schedule 1. The E2 Plan identifies 24 environmental emergency scenarios. Each substance has worst-case (WC) and alternate worst-case (AWC) scenario, and alternate scenarios ranging from C to D. Details are summarized below:

Substance	Hazard Category	Emergency Scenario
Methane	E	WC1, AWC1, C1, D1
Acetylene	E	WC2, AWC2, C2
Nitric Acid	I	WC3, AWC3, C3
Ammonium Nitrate	O	WC4, AWC4, C4, D4
Fuel Oil, No. 4	F	WC5, AWC5, C5
Fuel Oil No. 2	F	WC6, AWC6, C6
Cadmium chloride	A	WC7, AWC7, C7, D7

In total, five hazard categories need to be exercised annually (E, I, O, F, A), and a total of 24 scenarios exercised over time. Because there are a number of substances, multiple hazard categories, and differing numbers of environmental emergency scenarios, the cycle for simulation exercises will be different for most substances. As a result, they will be unevenly staggered over the years. An example of a schedule that would meet regulatory requirements is below. Please note that a references to a year number means to repeat the exercise for that substance in that particular year.

Hazard Exercised	Year	1	2	3	4	5	6	7	8
E **I** **O** **F** **A**	Exercise	AWC1 C3 WC4 C5 D7	C2 WC3 C4 AWC5 AWC7	D1 AWC3 AWC4 WC5 C7	WC2 Year 1 D4 C6 WC7	Full Scale	WC1 Year 2 Year 1 AWC6 Year 1	AWC2 Year 3 Year 2 WC6 Year 2	C1 Year 4 Year 3 Year 1 Year 3

Example D – Single substance with secondary hazard characteristics

Site D stores hydrochloric acid onsite that exceeds the quantity and concentration thresholds in Schedule 1 of the E2 Regulations. It is identified as an inhalation hazard in the E2 Regulations, but also possesses aquatically toxic qualities. While developing their E2 Plan, the facility came to the conclusion that for this particular site, the aquatically toxic properties of the substance were not addressed in the scenarios identified to address the

inhalation risks. As a result, an additional scenario was developed to ensure that all hazards were captured in the facility's E2 Plan. Details are summarized below:

Emergency Scenario	Hazard Addressed
Worst-case (WC)	Inhalation
Alternate worst-case (AWC)	Inhalation
Alternate scenario C	Inhalation
Alternate scenario D	Aquatic toxicity

The E2 Regulations require that one scenario is exercised annually until all identified scenarios have been exercised, and the cycle must begins again. An example of a schedule that meets the regulatory requirements is as follows:

Year	1	2	3	4	5	6	7	8
Exercise	WC	C	D	AWC	Full Scale	WC	C	D

6.2 Full-scale exercise

A full-scale exercise is an action-based exercise that involves the deployment of personnel, resources and equipment. It is typically conducted in real time and with current weather conditions. Full-scale exercises give the response team an opportunity to practise and validate their plans, policies and a wide variety of the skills covered in response training.

Section 7(1)(b) of the E2 Regulations requires that a full-scale simulation exercise be conducted within five years of the E2 plan being brought into effect. This exercise must simulate either the worst-case scenario or the alternate worst-case scenario identified in a facility's E2 Plan. If a facility has not identified an alternate worst-case scenario in their E2 Plan, the full scale exercise must be completed for the worst-case scenario. When designing an exercise, the responsible person should take into consideration any lessons learned during previous exercises. These exercises may involve other agencies, although role-players representing other agencies can also be used.

6.2.1 Cycle for full-scale exercises

The E2 Regulations do not prescribe a regulatory cycle for full-scale exercises. However, ECCC recommends that if a facility has identified more than one regulated substance in

their E2 Plan, that they implement a rotational system so that all hazard categories and substances are eventually exercised, starting with the highest risk scenarios first.

6.3 Record keeping and Reporting

Once the full-scale exercise is completed, a Notice Regarding Simulation Exercises Conducted in Relation to an E2 Plan (Schedule 5) must be submitted through the online reporting system. This notice will also ask for confirmation that the annual simulation exercises have been conducted in the previous years. Please note that because the full scale exercise is not required to be completed until after the E2 Plan has been brought into effect, the reporting system will not generate the appropriate notice until after the notice referred to in Schedule 4 (Information to Be Submitted in the Notice Regarding the Bringing Into Effect of an Environmental Emergency Plan) has been submitted. Additional information on the submission of notices to ECCC can be found in Section 4 of this document.

In addition to the E2 Plan, the following records are also required to be kept at the facility:

- A record of the simulation exercises undertaken, including both annual and full-scale exercises. The record for each exercise must include: the date the exercise took place, a summary of the exercise, and the results of the exercise. Any modifications required to the E2 Plan that were identified during the exercise must also be recorded.

- A record of the dates of the annual review of the E2 Plan by the responsible person. If necessary, the E2 Plan must also be updated to ensure that it continues to meet regulatory requirements.

Note that these records are not required to be submitted to ECCC, but must be stored onsite for seven years. They may be verified through site inspections. ECCC recommends an Appendix be placed within the E2 plan to record this information so it can be presented for inspection upon request. Other methods of records management are also acceptable, provided the records can be easily presented upon request under any circumstances.

6.4 Frequently Asked Questions

The following provides guidance for questions regarding E2 exercises that frequently arise.

Question: Can I exercise multiple hazard classes in one exercise?

Answer: A facility can simulate different hazard categories in the same exercise as long as these hazards are addressed by scenarios that were identified in the E2 Plan and the responsible person prepares a record that clearly identifies: the substance and the hazard classes that were being exercised, and a summary of the results of the simulation exercise as required under the E2 Regulations.

Question: If a facility performs full scale simulations on an annual or more frequent basis, do they still need to simulate a substance from each category on an annual basis?

Answer: During years 1 to 4, a full scale exercise could replace the requirement for annual simulations, provided the scenario(s) have been identified in the E2 Plan and all of the hazard classes present at a facility are simulated during the exercise(s) that take place over the course of the year. In the event that this is not the case, a simulation would be required for those hazard classes not covered by the full scale exercise(s).

During year 5, carrying out one full scale exercise would be sufficient to comply with the E2 Regulations.

Question: Can an actual incident be used as a full-scale exercise?

Answer: An actual incident can be used as a full scale exercise if:

- it involves a scenario identified in the E2 plan;
- it had an effect beyond the boundaries of the facility;
- all of the measures identified in the E2 Plan were implemented; and
- a summary of the incident and the results have been appropriately documented.

Question: Can I make use of an exercise done for another regulation?

Answer: If a facility is simulating an exercise to meet the requirements of another regulation, this exercise can be used for the purpose of the E2 Regulations as long as it simulates a scenario identified in the E2 Plan and fulfills all of the E2 regulatory requirements for exercising an E2 Plan. The detailed record and summary of the results of the simulation exercise should also specify all of the regulations that this exercise was meant to satisfy. .

Question: If a facility has to do a simulation exercise for an aquatic hazard, but it is situated in an industrial sector with no aqueous receptor, is an annual exercise still required?

Answer: In this situation, modelling of any passive mitigation measures used to contain the substance should be done to ensure that they are functionally able to perform as expected in the event of an environmental emergency. The assessment(s) should also cover any secondary hazards that are associated with the substance. If the release scenarios still do not result in an environmental emergency then exercising is not required. However, the notice referred to in Schedule 5 must still be submitted, clearly indicating why the exercise did not take place. The passive mitigation measures should also be reviewed at least every five years to ensure that they remain appropriate.

Question: If two facilities have mutual aid agreements in place, can a full-scale exercise at one facility be documented for the second facility as well?

Answer: The full-scale exercise is site specific. It requires the deployment of personnel, resources and equipment based on the procedures described in the E2 Plan. ECCC also encourages participation of the local first response community where possible. As a result, facilities subject to the E2 planning requirements of the E2 Regulations that participate in mutual aid exercises at other facilities typically cannot count their participation as an exercise of the E2 Plan for their facility. Although lessons can be learned from participation, an exercise of the E2 plan for the participating facility is still required.

7.0 Notification of an Environmental Emergency

When any of the substances listed in Schedule 1 of the E2 Regulations is accidentally released, it may result in an environmental emergency that must be reported to ECCC. Prompt and accurate reporting of these incidents is essential to help ensure that affected parties are notified in a timely manner and can also reduce harmful environmental and human health impacts. This section provides information on what constitutes a reportable environmental emergency, and how and when it must be reported. A quick reference diagram can be found in Figure 7 on page 80.

Spill Reporting Requirements under Other Legislation

The information in the following section pertains ***only*** to the reporting of environmental emergencies under Section 18 of the E2 Regulations. Please note that there may be requirements for the reporting of spills or accidental releases of a substance under other legislation. It is incumbent on the responsible person to be aware of and comply with all of the reporting requirements that apply to their facility.

The responsible person is ultimately responsible for compliance with the Regulations.

7.1 Authority

The authority for the E2 Regulations is provided by Part 8 of CEPA, 1999, which defines an "environmental emergency" as:

(a) an uncontrolled, unplanned or accidental release, or release in contravention of regulations or interim orders made under this Part, of a substance into the environment; or

(b) the reasonable likelihood of such a release into the environment.

Section 194 of CEPA , 1999, further defines this by stating that any obligations under the E2 Regulations apply only in relation to environmental emergencies that:

(a) have or may have an immediate or long-term harmful effect on the environment;

(b) constitute or may constitute a danger to the environment on which human life depends; ***or***

(c) constitute or may constitute a danger in Canada to human life or health.

7.2 What is a Reportable Environmental Emergency?

Based on these authorities, the reporting of environmental emergencies under Section 18 of the E2 Regulations is only required when the criteria listed above are met (i.e., the release must be uncontrolled, unplanned, or accidental ***and*** have the potential to harm the environment, human life, or health). The responsible person must use their professional judgement to determine whether or not a release from their facility meets the reporting criteria. If there is any doubt as to whether the incident is a reportable environmental emergency, it is best to err on the side of caution, and report.

7.3 Which E2 Substances are subject to reporting requirements?

Environmental emergencies involving any of the substances listed in Schedule 1 of the E2 Regulations are required to be reported as soon as possible, unless they meet exclusion criteria. The obligation to report applies whether or not the quantities of substances, or container system capacity, meet or exceed the specified quantity threshold identified in column 4 of Schedule 1 of the E2 Regulations.

7.3.1 Reporting Exclusions

Chemicals that do not meet the concentration criteria in Column 3 of Schedule 1 of the E2 Regulations, and those which are exempt based on the exclusions in Sections 2(2) of the E2 Regulations, are not considered substances as defined by the E2 Regulations, and therefore are not subject to the reporting requirements. Additionally, the E2 Regulations do not require reports on the release of any accidental by-products, including those that arise from combustion. Please note that there may be other regulations under which the reporting of these releases is required. If there is any doubt as to whether the incident should be reported, it is best to err on the side of caution and report verbally via one of the telephone number available through the Canadian Incident Notification System identified in section 7.6 below.

7.4 When must notification occur?

Section 18(1) of the E2 Regulations refers to Paragraph 201(1)(a) of CEPA, 1999, which requires that both verbal and written notification of an environmental emergency be provided.

The verbal notification must take place as soon as it becomes apparent that the incident is imminent, or as soon as possible after the incident has occurred.

The written notification must take place as reasonably soon after the emergency has occurred and the responsible person is able to describe the measures taken to mitigate any harmful effects, and identify any measures required to prevent a recurrence of similar events. If a responsible person determines after the release has occurred that it did not in fact meet the criteria for an environmental emergency, a written report would no longer be required. However, they should provide a verbal update to the telephone number originally contacted in order to close the file.

7.5 Who is responsible for providing notification?

Notification of an environmental emergency must be performed by:

- any person who owned or had the charge, management or control of the substance immediately before the environmental emergency, or
- any person who caused or contributed to the environmental emergency.

This requirement exists regardless of whether or not that person is subject to any other requirement under the E2 Regulations. For example, facilities that have not previously submitted a Notice Regarding Substances Located at a Facility (Schedule 2) are still required to report environmental emergencies.

7.6 How *must n*otification *be provided*?

7.6.1 Verbal Notification

Immediate verbal notification must take place by calling the applicable phone number identified in the table below which is associated with the province or territory where the environmental emergency occurred.

Table 5. Regional Contact Information

Province	24-hour Telephone Line
Newfoundland and Labrador	1-709-772-2083 or 1-800-563-9089
Prince Edward Island	1-902-426-6030 or 1-800-565-1633
Nova Scotia	1-902-426-6030 or 1-800-565-1633
New Brunswick	1-902-426-6030 or 1-800-565-1633
Quebec	1-514-283-2333 or 1-866-283-2333
Ontario	1-416-325-3000 or 1-800-268-6060
Manitoba	1-204-944-4888
Saskatchewan	1-800-667-7525
Alberta	1-780-422-4205 or 1-800-222-6514
Nunavut	1-867-920-8130

Northwest Territories	1-867-920-8130
British Columbia	1-800-663-3456
Yukon	1-867-667-7244

7.6.2 Written Notification

Written notification of environmental emergencies must take place through the electronic submission of a notice containing the information identified in Schedule 8 of the E2 Regulations.

The Schedule 8 report must include:

- The reporter's contact information.
- If applicable, the name of the facility or person responsible for the emergency
- If applicable, the North American Industry Classification System (NAICS) codes
- The date and time of the release
- The location of the release
- The CAS number and, if applicable, the UN number of the substance
- The quantity of the substance released
- If applicable, a description of the container system and its condition
- A description of the (potential) harmful effects of the emergency on the environmental and human health
- If known, a description of the circumstances leading to the emergency, and measures taken to mitigate any harmful effects
- A description of all measures taken to prevent similar events from recurring

Please note that any fields requesting additional information in the E2 Online Reporting System are voluntary, and not prescribed by the E2 Regulations.

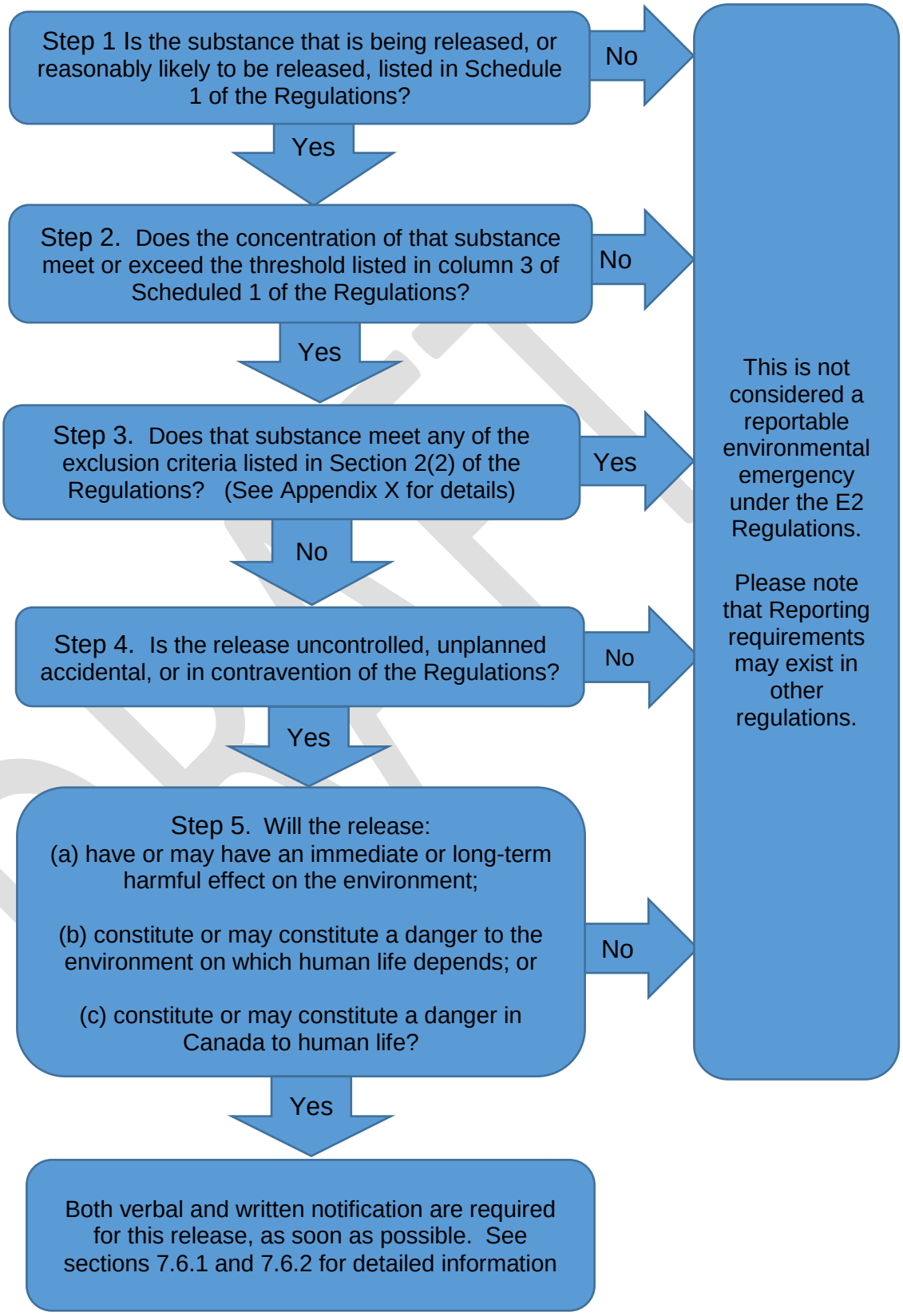
7.6.2.1 Access to the E2 Online Reporting System

Facilities that are registered in the E2 Online Reporting System must submit their report by logging in using their sign-in partner or GCKey credentials, and submitting a Schedule 8 notice from the dashboard. The link to the SWIM portal is: https://ec.ss.ec.gc.ca).

A facility or person that is not registered in the E2 Online reporting system must submit a written report regarding an environmental emergency through the following public link: https://pollution-waste.canada.ca/spill-reporting. Completing this process fulfills the requirements for the provision of a written report under Section 18 of the E2 Regulations.

Detailed information on how to proceed with the submission process can be found in the section of the Online Reporting System Guidance document that deals with Schedule 8 submissions at: http://publications.gc.ca/collections/collection_2019/eccc/En14-389-2019-eng.pdf. Regional offices may also be contacted for assistance at: ec.ue_gigue2_swim.ec@canada.ca

Figure 7. Quick Reference Diagram for Reportable E2 Releases



8.0 Access to Information for Public Safety Authorities

Public safety authorities (PSAs) may request access to the information stored in the Environmental Emergencies database by registering under the “Public Safety Authorities” section of the E2 Online Reporting System. The system is accessed via ECCC’s Single Window Interface: https://ec.ss.ec.gc.ca.

Access to information that is classified for either confidential business or national security reasons may be granted to the extent that such access is legally permissible, and on a need-to-know basis only,

8.1 Benefits for PSAs

Information in the E2 database can be beneficial for PSAs in various ways. This access can

- increase planning capacity
- improve training to focus on real scenarios that could occur at facilities in the area
- inform where best to stage equipment for response
- inform municipalities so they are better prepared to assist with public notification if needed
- make them better prepared to assist with public notification if needed

9.0 Compliance and Enforcement

ECCC evaluates the accuracy and completeness of the notices and reports submitted under the E2 Regulations. This evaluation assists the Department in determining:

- whether the regulatee must submit E2 Plan reports and notifications;
- when the regulatee must submit E2 Plan reports and notifications; and
- whether ECCC should refer possible situations of non-compliance to enforcement officers for investigation.

As part of an ongoing monitoring process, ECCC may request that copies of E2 Plans be submitted to the Department for review. Such action will help ECCC determine whether environmental emergency planning is adequate to ensure the safety of Canadians.

9.1 Investigation of possible non-compliance

Enforcement officers apply the Compliance and Enforcement Policy for CEPA 1999 when verifying compliance with the E2 Regulations. This policy sets out the range of possible responses to alleged violations: warnings, directions, environmental protection compliance orders (EPCOs), ticketing, ministerial orders, injunctions and prosecution, as well as environmental protection alternative measures (EPAMs). The Compliance and Enforcement Policy for CEPA 1999 can be accessed at: https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/compliance-enforcement-policy.html

For the purposes of enforcing the E2 Regulations under section 218 of CEPA 1999, enforcement officers are authorized to enter places and inspect E2 Plans and any other relevant records in order to confirm compliance with the E2 Regulations.

When an enforcement officer discovers an alleged violation, the officer will choose the appropriate enforcement action based on the following factors:

- Nature of the alleged violation: This includes consideration of how serious the harm or potential harm is, what the reason for the alleged violation is, whether this is a repeated occurrence and whether attempts have been made to conceal information or otherwise subvert the objectives and requirements of CEPA 1999.

- Effectiveness in achieving the desired result with the alleged violator: The desired result is compliance with CEPA 1999, within the shortest possible time and with no further occurrence of violation. Factors to be considered include:
    - the violator's history of compliance with CEPA 1999 and, if applicable, with regulations by a provincial, territorial or Indigenous government that are deemed, by order in council, to be equivalent to those under the CEPA 1999;

- the violator's willingness to co-operate with enforcement officers;
- evidence of corrective action already taken; and
- the existence of enforcement actions under other statutes by other federal authorities or by provincial, territorial or Indigenous governments as a result of the same activity.

- Consistency in enforcement: Enforcement officers strive to achieve consistency in their responses to alleged violations. Accordingly, officers consider how similar previous situations were handled when deciding what enforcement action to take.

10.0 Summary of the Risk Evaluation Framework

This section introduces the evaluation methodology that ECCC has developed and is using to evaluate the properties of chemical substances that would prove hazardous in the event of an environmental emergency, and to calculate the threshold quantity for substances listed in Schedule 1 of the E2 Regulations.

The Risk Evaluation Framework (REF) is designed to

- evaluate the risk posed by a substance to the environment and human health;
- determine the need to add this substance to Schedule 1 of the E2 Regulations, based on the risk evaluation results obtained; and
- calculate the minimum quantity (the threshold) for substances listed in Schedule 1 of the E2 Regulations.

Section 200 of CEPA 1999 is the authority that allows the Governor in Council to make regulations establishing a list of substances that, should they enter the environment as a result of an environmental emergency, might be harmful to the environment, or to human life or health. Section 200 also gives the Governor in Council the authority to prescribe a minimum quantity for these substances.

In 2003, when the E2 Regulations were published, the REF had not yet been developed. As a result, most of the substances in Schedule 1 (parts 1 and 2) were adopted from the USEPA regulations and some substances came from the Major Industrial Accidents Reduction Council (MIARC), known as the Conseil pour la réduction des accidents industriels majeurs (CRAIM) in French. These thresholds, therefore, were not generated by the REF. The rationale for the MIARC list focused almost entirely on human health and safety criteria (CRAIM 2002; J.P. Lacoursière Inc. 2002). The first amendment to the E2 Regulations added substances from the Toxic Substances List (CEPA 1999), and other substances of concern. The new substances added to the 2019 E2 Regulations are mostly substances that were pre-screened under the Chemical Management Plan and then further evaluated by the E2 Prevention Division for thresholds and policy implications.

The regulated list is not a static one. ECCC continues to assess CEPA 1999 substances and other substances of concern (reactives, petroleum substances, inhalation toxics, etc.) for possible inclusion in the E2 Regulations. As part of this ongoing process, substances may be added to or removed from Schedule 1 of the E2 Regulations (for example, nickel carbonate was present in the 2011 E2 Regulations, but was removed in the new 2019 E2 Regulations), or thresholds may be adjusted if new data show such adjustments to be warranted.

APPENDIX 1

Regional Contact Information for the E2 Regulations

For assistance regarding the E2 Regulations or filing notices, please contact your regional representative. For all other enquiries regarding the E2 Regulations, please contact the national office.

Region	Regional Environment and Climate Change Canada Office	Written Report (if Electronic Submission is not Possible) [1]
Atlantic Region: • Nova Scotia • New Brunswick • Newfoundland and Labrador • Prince Edward Island	Compliance Promotion - Environmental Emergencies Program Atlantic Region Environment and Climate Change Canada 45 Alderney Drive, 15th Floor, Queen Square Dartmouth, Nova Scotia B2Y 2N6 Phone: 1-800-668-6767 Email: ec.ue-atl-e2.ec@canada.ca	Regional Director, Environmental Enforcement Directorate Atlantic Region Environment and Climate Change Canada Queen Square 45 Alderney Drive Dartmouth NS B2Y 2N6 Fax: 902-426-7924
Quebec Region	Compliance Promotion - Environmental Emergencies Program Quebec Environment and Climate Change Canada 351 St-Joseph Blvd Gatineau, Quebec K1A 0H3 Phone: 1-800-668-6767 Email: ec.ue-qc-e2.ec@canada.ca	Regional Director, Environmental Enforcement Directorate Quebec Region Environment and Climate Change Canada 105 McGill Street (3rd Floor) Montréal QC H2Y 2E7 Fax: 514-496-2087

1. Electronic submission is mandatory except in special cases where an electronic version is impossible.

Region	Regional Environment and Climate Change Canada Office	Written Report (if Electronic Submission is not Possible) [1]
Ontario Region	Compliance Promotion - Environmental Emergencies Program Ontario Region Environment and Climate Change Canada 4905 Dufferin Street Downsview, Ontario, M3H 5T4 Phone: 1-800-668-6767 Email: ec.ue-on-e2.ec@canada.ca	Regional Director, Environmental Enforcement Directorate Ontario Region Environment and Climate Change Canada 845 Harrington Court Burlington ON L7N 3P3 Fax: 905-333-3952
Prairie and Northern Region: • Alberta • Saskatchewan • Manitoba • Northwest Territories • Nunavut	Compliance Promotion - Environmental Emergencies Program Prairie and Northern Region Environment and Climate Change Canada 9250 – 49th Street NW Edmonton, Alberta, T6B 1K5 Phone: 1-800-668-6767 Email: ec.ue-pn-e2.ec@canada.ca	Regional Director, Environmental Enforcement Directorate Prairie and Northern Region Environment and Climate Change Canada Twin Atria Building 4999 – 98th Avenue, Room 200 Edmonton AB T6B 2X3 Fax: 780-495-2451
Pacific and Yukon Region: • British Columbia • Yukon	Compliance Promotion – Environmental Emergencies Program Pacific and Yukon Region Environment and Climate Change Canada 201 – 401 Burrard Street Vancouver, British Columbia, V6C 3S5 Phone: 1-800-668-6767 Email: ec.ue-py-e2.ec@canada.ca	Regional Director, Environmental Enforcement Directorate Pacific and Yukon Region Environment and Climate Change Canada 201 – 401 Burrard Street (4th Floor) Vancouver BC V6C 3S5 Fax: 604-666-9059

Region	Regional Environment and Climate Change Canada Office	Written Report (if Electronic Submission is not Possible) [1]
National Office	Environmental Emergencies Program Environment and Climate Change Canada 351 St. Joseph Boulevard Gatineau, Quebec, K1A 0H3 Phone: 1-800-668-6767 Email: ec.ue-e2.ec@canada.ca	

APPENDIX 2

Dealing with Mixtures under the *E2 Regulations*

Dealing With Mixtures under the *E2 Regulations*

Although a mixture may not have a CAS#, or has a CAS# that is not identified in Schedule 1 or 2 of the E2 Regulations, if it contains any of those regulated substances it needs to be assessed to determine whether or not the E2 Regulations apply. This appendix outlines:

1. How to determine if a mixture is subject to the E2 Regulations;
2. Required schedules and timelines for their implementation
3. How to prepare an E2 Plan for a mixture;
4. How to identify scenarios pertaining to the accidental release of a mixture;
5. How to determine the impact distance of an accidentally released mixture; and
6. How to develop and implement simulation exercises for a mixture.

1. How to Determine if a Mixture is Subject to the E2 Regulations

This section is designed to assist in the determination of whether or not the E2 Regulations apply to a particular mixture. It consists a quick reference diagram (flow chart), sample analysis, and associated calculations.

Prior to proceeding with the flowchart**,** a regulatee must first determine if the mixture meets the requirements for any exclusions identified in Section 2(2) of the E2 Regulations. Guidance on exclusions can be found in Appendix 5 of these Guidelines.

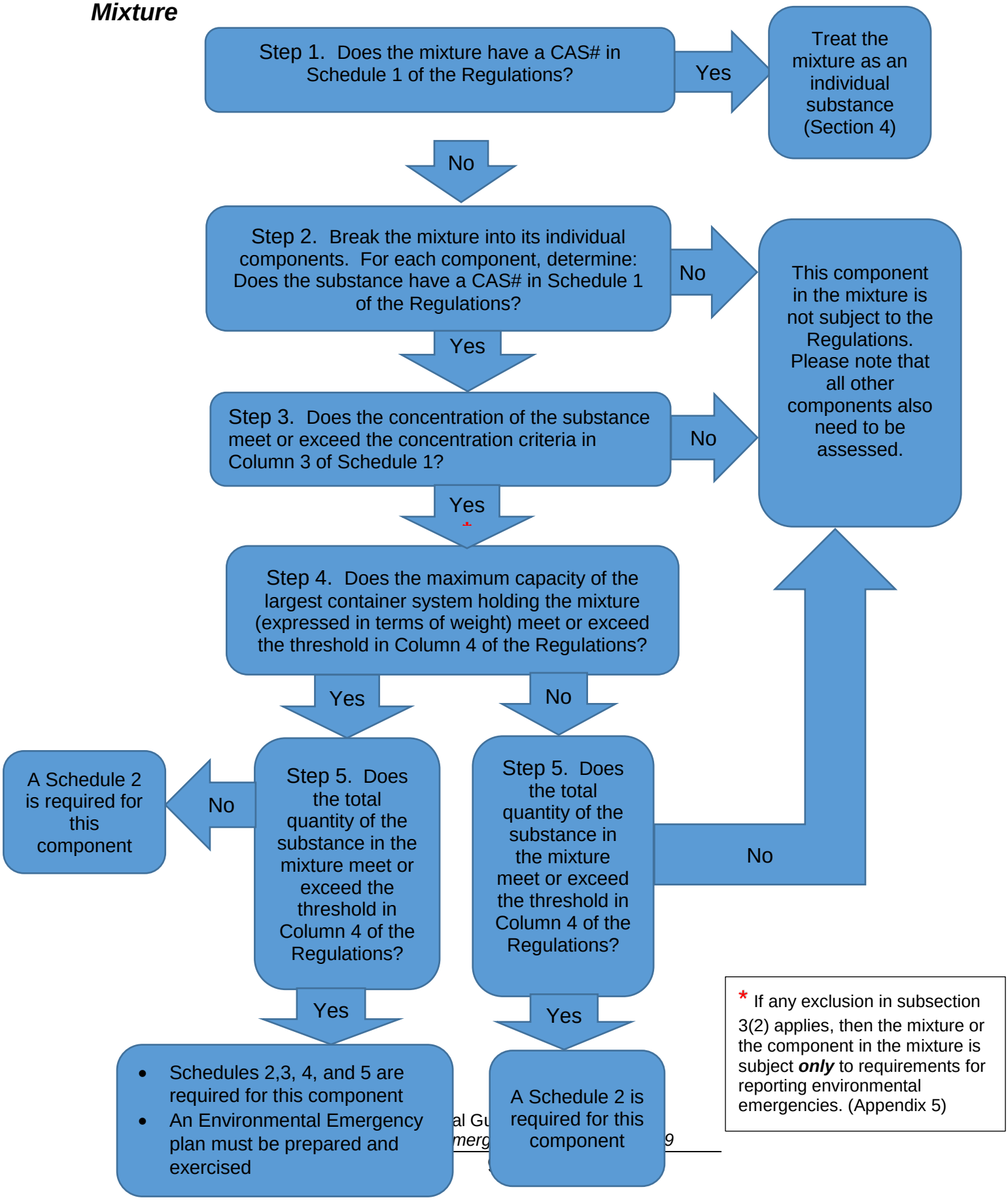
- If an exclusion does apply, then the E2 Regulations do not apply to that mixture.
- If an exclusions does not apply, the flow chart in Figure 8 should be consulted to determine whether or not the E2 Regulations apply, and identify any follow up actions that might be required.

For Step 3 in the flowchart, if the exact concentration of the individual components in a mixture is not known, then the upper range of concentration by weight that is listed on the SDS for each substance should be used to calculate the proportion within the mixture. Sample calculations can be found in examples 7b and 9 of Appendix 4.

If Step 4 of the flowchart is required, the maximum capacity of the largest container system holding the mixture must be assessed against the associated threshold value in Column 4 of Schedule 1 of the E2 Regulations. The threshold values are expressed in a unit of mass (i.e., tonnes, kg, lbs). If a conversion is required to find the weight of a liquid, the following equation should be used:

Maximum Capacity of Container System	**=**	***Density of the entire mixture (including non-E2 components)***	x	***volume of the container system***

Figure 8. Flowchart to Determine if the E2 Regulations Apply to a Mixture



To perform the assessment in Step Five, the total quantity of the regulated substance(s) in the mixture must be calculated by multiplying their concentration by the total quantity of the mixture. Sample calculations can be found in Appendix 4 of this document. If the concentration of the substances in the mixture is not known, the upper range listed by weight on the SDS will be considered to be their proportion within the mixture. Under these circumstances, the percentages for each component in the mixture may have to be normalized to determine their total quantity. Note that the normalized percentage is ***not*** to be used for Step 3 in Figure 8. Sample calculations of this nature can be found in examples 7b and 9 in Appendix 4.

Fig. 9 Sample calculation for quantity of substances in a mixture (for Step 5):

E2 Substance in Mixture	Concentration %	Total Quantity of the Substance in a Mixture of 79 tonnes (79 Tonnes x %)	Threshold Criteria from Column 4 of Schedule 1 (tonnes)
Naphtha (C)	10	7.9	50
Methane (E)	20	15.8	4.5
Propane (E)	60	47.4	4.5
Benzene (C)	9.5	7.505	10
2,2-dimethylpropane (E)	0.5	0.5% < 1%, therefore does not meet the concentration threshold	

Fig. 10 Sample assessment of quantity and container system thresholds for the mixture where maximum capacity of largest container system = 40 tonnes

E2 Substance	Conc. (%)	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity Compared to Threshold (tonnes)	Schedules to fill out	E2 Plan Required
Naphtha	10	40 ≥ 50 No	7.9 ≥ 50 No	None	No
Methane	20	40 ≥ 4.5 Yes	15.8 ≥ 4.5 Yes	2, 3, 4, 5	Yes
Propane	60	40 ≥ 4.5 Yes	47.4 ≥ 4.5 Yes	2, 3, 4, 5	Yes
Benzene	9.5	40 ≥ 10 Yes	7.505 ≥ 10 No	2	No
2,2-dimethylpropane	0.5	0.5% < 1%, therefore does not meet the concentration threshold		None	No

Additional examples of mixture calculations can be found in Appendix 4 of these Guidelines.

2. Required Schedules and Their Timelines for Implementation

The flow chart in Figure 8 covers the most commonly used schedules. Other schedules may also apply to a facility that is required to have an E2 plan. A summary of the full list of schedules contained in the E2 Regulations and their due dates can be found in Section 4.1.2 of these Guidelines. Information on how to submit the schedules to Environment and Climate Change Canada can be found in Section 4.1.3.

3. How to Prepare an E2 Plan for a Mixture

Section 4(1) of the E2 Regulations requires that an E2 Plan be prepared with respect to a regulated substance. In practical terms, it is acceptable if the E2 Plan refers to more than one substance, provided the content covers all of the different prevention, preparedness, response, and recovery measures required for the various substances onsite.

Given that the properties and characteristics of the mixture may differ from those of the individual substances contained within (e.g. boiling point), both the impacts of and the response to an environmental emergency should be determined based on the characteristics of the mixture as a whole and not its individual components. Ideally, modelling software will be able to predict the behaviour of the mixture in the event of a release to the environment. As a result, one E2 Plan may be prepared for the mixture itself, as opposed to a number of E2 Plans being prepared independently based on the individual characteristics of each regulated substance contained in the mixture. This will also enable the differentiation between potential environmental emergencies at facilities that store both a pure substance and a mixture containing that same substance.

To ensure that the regulated substances are properly referenced, the E2 Plan must clearly identify the individual substance(s) within the mixture for which it has been prepared. Using the mixture in the example above, the statement would read “this E2 Plan has been prepared in the event of the release of quantities of (insert name of mixture) which is comprised of methane, propane, and benzene contained in a mixture with naphtha and 2,2-dimethylpropane in concentrations of 20%, 60%, 9.5%, 10%, and 0.5%, respectively.”

4. How to Identify Scenarios Pertaining to the Accidental Release of a Mixture

The E2 Plan must identify any environmental emergency that could reasonably be expected to occur at a facility and would likely cause harm to the environment or constitute a danger to human life or health. Section 4(2)(e) of the E2 Regulations also requires that a facility identify the harm from a scenario that involves the release of:

a. the maximum quantity of an E2 substance that can be contained in the largest container system, and if applicable,
b. the maximum expected quantity of an E2 substance that is on-site but not contained. For example, ammonium nitrate stored in a pile.

This is considered the worst-case scenario.

Section 4(2)(f) of the E2 Regulations further requires that the facility identify the harm from the environmental emergency (if applicable) that:

- Is more likely to occur than the worst-case scenario; and
- Would have the longest impact distance outside the boundary of the facility.

In the event that a mixture containing substances subject to the E2 Regulations is released to the environment, the release will come from the container system(s) holding the mixture; the regulated substance(s) contained in the mixture will not be released individually. The characteristics of the mixture may also be different from the individual components in their pure form, as antagonistic or synergistic effects between substances may modify the properties and the risk(s) posed. Therefore, the scenarios could be based on the release of the entire mixture, and not its individual components.

Regulated substances are classified based on the type of hazard they present, as indicated in column 5 of Schedule 1 of the E2 Regulations. There are six hazard categories listed: aquatically toxic (A), combustible (C), explosion hazard (E), pool fire hazard (F), inhalation hazard (I), and oxidizer that may explode (O). If the mixture has secondary hazard characteristics that could impact the environment and / or human life and health, they must also be considered and planned for in the scenarios. For example, although an acid mixture might be classified as an inhalation hazard, it could also exhibit aquatically toxic characteristics if released to a waterbody.

Once identified, the scenarios then need to be evaluated to determine the potential harm to the environment and/or danger to human life or health that could result. Please note that more detailed information on the assessment of scenarios and preparation of an E2 Plan can be found in Section 5 of this document.

5. How to Determine the Impact Distance of an Accidentally Released Mixture

In order to evaluate the scenarios identified as part of an E2 Plan, the impact distance outside the boundary of the facility must be estimated for the release of the regulated substance(s). This is typically done through the use of modelling software or data tables that are available from a variety of sources.

As indicated above, the scenarios developed for mixtures could be based on the release of the entire mixture and not its individual components. In some cases, such as with a flammable mixture, a computer software program could be used to perform plume dispersion modelling of the entire mixture in order to estimate the impact distances for each scenario. Information on suggested endpoints for these calculations and references for performing this analysis can be found in Appendix 9 of these Guidelines.

It is the responsibility of the responsible person to determine the most appropriate mechanism to estimate the impact distance of the scenarios developed for their E2 Plans. A rationale to describe the selected methodology and its applicability for use in the

circumstance should also be included in the E2 Plan. The explanation provided should demonstrate that the risks from each scenario have been sufficiently estimated. The hazards determined to be associated with each scenario should also be documented in the E2 Plan.

6. How to Development and Implement Simulation Exercises for a Mixture

Section 7 of the E2 Regulations requires that E2 Plans be exercised at least once per year, beginning on the day on which the plan is brought into effect. These exercises take place over a five year cycle.

For the first four years of the cycle, the exercise(s) must include one regulated substance from each of the hazard categories present at the facility. If only one hazard category is present, then only one exercise is required. The exercise(s) must simulate a different environmental emergency each year until all of the emergencies identified in the E2 Plan for each hazard category have been exercised. Once completed, the simulations must be cycled through again.

Different hazard categories can be simulated in the same exercise as long as these hazards are addressed by scenarios that were identified in the E2Plan and a record is prepared to clearly identify the substance and the hazard class that were being exercised and a summary with the results of the simulation exercise as required under the E2 Regulations.

During the fifth year of the cycle, a full-scale exercise involving the deployment of personnel, resources and equipment described in the E2 Plan must be conducted for at least one regulated substance at the facility. The exercise must be for an environmental emergency identified in the E2 Plan that involves either the worst-case scenario (4(2)(e)) **or** the scenario more likely to occur that has the longest impact distance outside the boundaries of the facility (4(2)(f)). More detailed information on exercising E2 Plans can be found in section 6 of these Guidelines.

Where a simulation exercise involves the release of a mixture, if the components of the mixture all have the same hazard category, the simulation exercise would be considered to be for the category that represents the entire mixture.

Where a mixture is made up of components with different hazard categories, the potential for multiple hazards in the event of a release should have been assessed and planned for in the scenarios developed for the E2 Plan (see above – How to Identification Scenarios for the Release of a Mixture). That analysis would have identified any additional activities that might be required to address multiple hazard categories during an unplanned release, and ensured that they were documented in the E2 Plan.

Under these circumstances:

- If it has been determined that the release of the mixture would be associated with one hazard category, then the simulation exercise would be considered to be for that hazard category.

- If it has been determined that the mixture's release would involve multiple hazards, which have been identified and planned for in the scenario, the exercise would be considered to be for all of those hazard categories.

APPENDIX 3

Container Systems and Valves

The E2 Regulations require that any facilities that use, store, or create any of the 249 E2 substances on site to calculate the maximum capacity of the container system in which the substance is stored, ignoring safe fill limits. This value is then used to determine their regulatory obligations for that substance.

A container system is defined as "*any receptacle or network of receptacles that is used to contain a substance - including any connected pipelines or piping - except any part of that network that is automatically or remotely segregated from the rest of the network by shut-off valves, or other mechanisms, in the event of any environmental emergency*". This means that multiple containers connected with piping would be considered to be a single container system, unless they can be automatically or remotely segregated. This is also means that the placement and type of a segregation valve can affect a facility's reporting obligations.

How to determine the maximum capacity of a container system

The capacity of a container system is determined by the valves and other mechanisms in place to segregate one part of the system from another. The reportable size of a container system can be reduced through the presence of automatic or remotely operated valves, or other mechanisms. Having a smaller container system aligns with one of the principles of Inherent Safety (i.e. minimization) which reduces the potential risk of larger releases at facilities.

To be considered capable of segregating a portion of a container system, the valves / mechanisms must be automatic or be able to be remotely operated from outside the potential affected area during an emergency. A manual valve is not sufficient; containers that are separated by a manual valve would be considered one entire container system. Consequently, the volume of all of the interconnected containers and the entire piping assembly would be included when calculating the maximum capacity. If an automatic valve is present between the containers, they would each be considered separate container systems and only the quantities contained within the single container and pipes up to the automatic valve would be considered in the calculation. The diagram in figure 1 on the following page provides examples to assist in the determination of whether linked containers should be considered as one container system or separate individual containers when calculating maximum capacity.

What is considered an automatic or remotely operated shut-off valve?

A shut-off valve is a valve designed, installed and maintained for the primary purpose of achieving rapid isolation of interconnected containers and piping containing hazardous substances in the event of a container system failure.

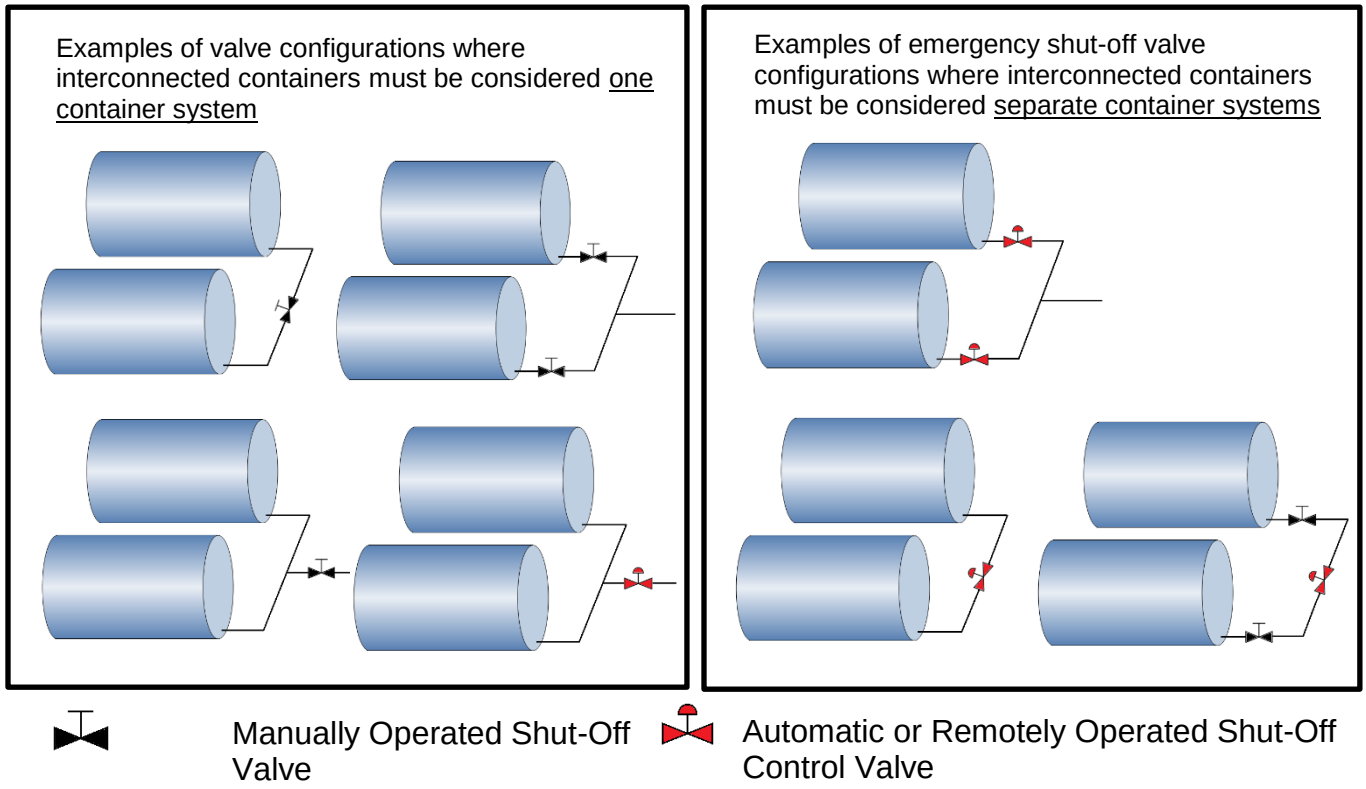
Factors that influence the decision about the type and location of isolation valves or other mechanisms may include, but are not limited to: the substance's properties, the

associated hazards, the operating conditions, release scenarios, release detection methods and timing, the potential for escalation, and the pathways for exposure.

When determining if a container system has an automatic or remotely operated shut-off valve or other mechanism (henceforth referred to as 'segregation system') under the new E2 Regulations there are three main considerations:

- Is the segregation system capable of completely segregating the container, ensuring there is no flow of substance between the container and the rest of the system?
- Can the segregation system be automatically or remotely operated from a safe distance on a 24/7 basis during an emergency?
- Is the segregation system capable of functioning in any type of emergency (e.g. fire, release)?

Figure 11. Examples of Valve Configurations for Container Systems



What is meant by "other mechanism"?

An "other mechanism" approach may involve utilizing a combination of engineered control systems which function in the same manner as an automatic or remotely operated shut-off valve. To be clear, all "other mechanisms" must also have the means to shut off the flow of a substance without the need to send an employee into a potentially dangerous location to manually turn or push a mechanism to stop the flow. For example, flare/flame arrestors are designed to stop fuel combustion by extinguishing a flame, but since the mechanism does not stop the flow of the substance, this would not be considered an "other mechanism" on its own. Manual valves located outside the area that could be potentially impacted are also not acceptable as they can fail and leak substances on their own.

Configurations to account for multiple hazards (i.e., Releases and Fires)

The segregation system must be capable of automatically or remotely segregating the container at any given time in the case of a release as well as a fire. A combination of valves and/or other mechanisms may be required in order to guard against both of these scenarios.

Example: A system may include a combination of an excess flow valve to guard against releases as well as a fusible link valve or local automatic fire suppression system to guard against fire.

Examples of automatic or remotely operated valves and other mechanisms that could be used in a segregation system*

Emergency Block Valve: Separates one item of equipment from another, isolating flammable or toxic substances in the event of a leak or fire.

Emergency Shut Down Valve: An actuated valve designed to stop the flow of a hazardous substance upon the detection of a dangerous event.

Excess Flow Valve: Closes automatically if flow rates exceed a critical value. The critical flow rate of excess flow valves depend upon the physical characteristics of the substance as well as flow rates. (Covers releases only. This system would need to be used in conjunction with a device that addresses fires.)

Fusible Link (Firomatic) Valve: Shuts off the flow from a container when the temperature exceeds a pre-set value due to a fire. (Covers fires only. This system would need to be used in conjunction with a valve that addresses releases.)

Fire Suppression System: A local automatic system which uses water and/or chemicals to extinguish a fire or prevent it from spreading. (Covers fires only. This system would need to be used in conjunction with a valve that addresses releases).

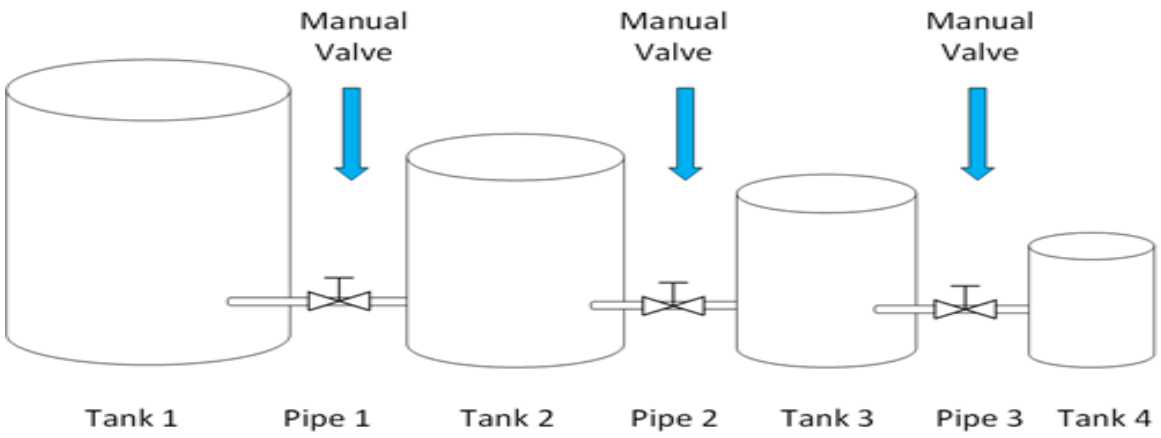
Safety Instrumented System (Emergency Shutdown System): A system comprised of sensors, logic solvers, and actuators for the purpose of preventing

a process from exceeding its normal operating parameters and returning it to a safe state when safe operating conditions are violated.

***Note:** The list above is not all-inclusive, and is intended for example purposes only.

How to Calculate the Maximum Capacity of a Container System The maximum capacity of a container system is calculated by adding the volume of each container, as well as the volume of any interconnected piping or other system receptacle. Several examples are below. Examples of calculations for the quantity of a substance in a container system can be found in Appendix 4.

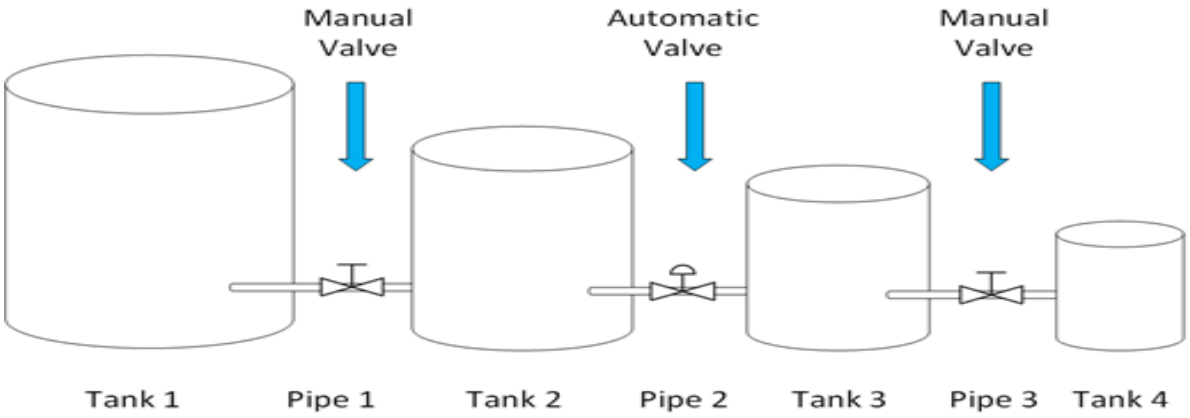
Example 1: Single Container System



This series of interconnected containers shows only manual shut-off valves, which do not segregate containers automatically or remotely. Therefore, this is considered to be one container system.

Container system: Tank 1 + pipe 1 + Tank 2 + pipe 2 + Tank 3 + pipe 3 + Tank 4

Example 2: Two Container Systems

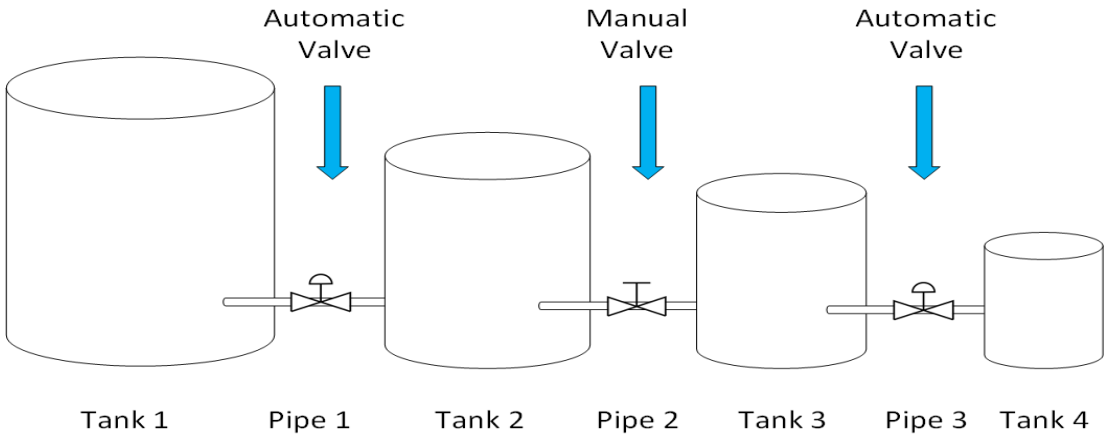


An automatic valve on pipe 2 is segregating the series of interconnected containers into two container systems:

Container system 1: Tank 1 + pipe 1 + Tank 2 + ½ pipe 2

Container system 2: ½ pipe 2 + tank 3 + pipe 3 + tank 4

Example 3 – Three Container Systems



In this example there are two automatic valves and one manual valve. The manual valve is ignored. In this case, this means that there are three container systems, starting from the left:

Container system 1: Tank 1 + ½ pipe

Container system 2: ½ pipe 1 + tank 2 + pipe 2 + tank 3 + ½ pipe 3

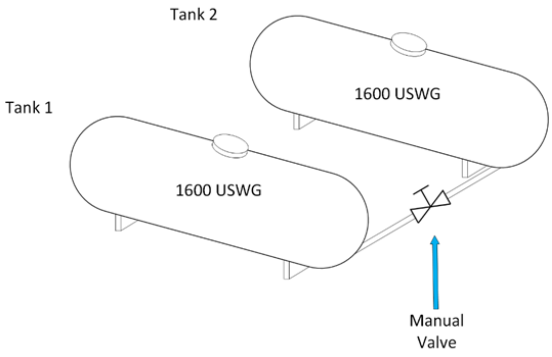
Container system 3: ½ pipe 3 + tank 4

Example 4: The difference the Placement of an Automatic Valve Can Make with Respect to E2 Reporting Obligations

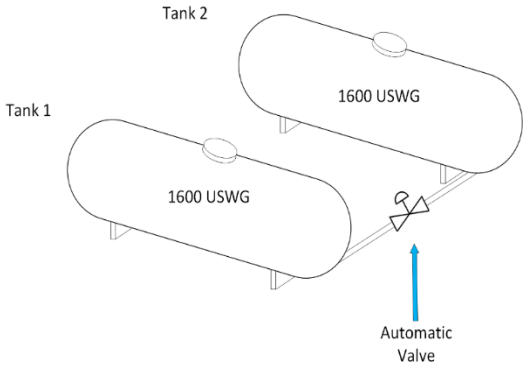
Two possible valve configurations for a pair of propane tanks are shown below. In the first scenario a manual valve is present between the two propane tanks. In this case the maximum capacity of the container system would be calculated to be 4010 USWG (~7.7 Tonnes)*, the sum of the two tanks and the pipe. However, in the second scenario the maximum capacity of the container system would be calculated to be 2005 USWG (~3.84 Tonnes)*, the sum of one tank and the half of the piping, due to the presence of the automatic valve.

For E2 reporting purposes, in Scenario 1, a Schedule 2, 3, 4, and 5 would be required whereas in Scenario 2, only a schedule 2 would be required because the maximum capacity of the container system in scenario 2 is less than threshold for propane which is 4.5 tonnes.

Scenario 1:



Scenario 2:



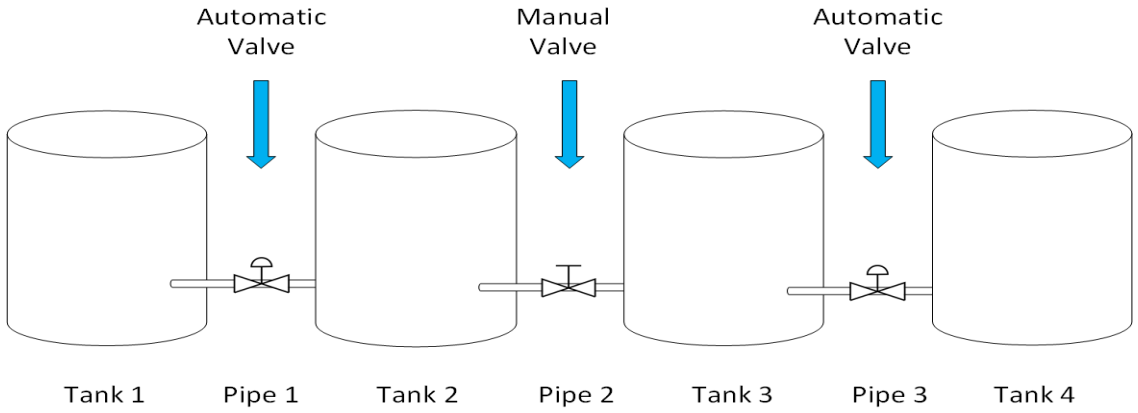
	USWG		
	Tank 1	Tank 2	Piping
Max. Capacity	2000	2000	10
Total Quantity	1600	1600	10

*1000 U.S. Water Gallons (USWG) =

$$1000\ US\ Gallons \times \frac{3.785\ Litres}{1\ US\ Gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{0.5066\ g}{1\ cm^3} \times \frac{1\ kg}{1\ 000\ g} \times \frac{1\ tonne}{1000\ kg}$$
$$= 1.917\ tonnes$$

Example 5: How to Report When Container Systems Holding the Same Product Have Different Capacities

Below is an example of a possible storage tank configuration at a tank farm. If it is assumed each tank in the example is 10 000 L, and each length of pipe holds 100 L. Factoring in the location of the automatic values, container systems 1 and 3 would have a capacity of 10 050 L. Container system 2 would have a capacity of 20 200 L due to the presence of the manual valve between Tanks 2 and 3. As such, the maximum capacity of the largest container system would be reported as 20 200 L. In cases where systems do not have identical capacities, the system with the largest capacity is reported.



In this case there are two automatic valves and one manual valve. The manual valve is ignored. This means that there are three container systems, starting from the left:

Container system 1: Tank 1 + ½ pipe 1 = 10,000 +50 = 10, 050

Container system 2:
½ pipe 1 + tank 2 + pipe 2 + tank 3 + ½ pipe 3 = 50 + 10,000 + 100 + 10,000 + 50 = **20,200**

Container system 3: ½ pipe 3 + tank 4 = 50 + 10,000 = 10,050

The maximum capacity of the largest container system would be reported as **20 200 L**

APPENDIX 4

Determination of Quantity of a Substance Onsite

Table of contents

Determination of the quantity on-site and the maximum capacity of the largest container system

If the entire quantity of a substance on-site is stored in a single container system, then the total quantity on-site would be the sum of the amounts found in each tank and in each of the pipes.

If the substance stored on-site is contained in more than a single container system, then whichever container system has the higher quantity capacity will be recorded as the maximum capacity of the largest container system.

To calculate the maximum capacity, add up the maximum capacity of all of the pipes and the 100% maximum capacity of each tank, without considering the Safe Fill Limits. Additional information on calculating the capacity of container systems can be found in Appendix 3 of this document.

Where the substance is stored in a container system and is also present in an uncontained state, the maximum capacity will be the larger value of the tonnage of the uncontained substance, or the maximum capacity of the largest container system.

Quantity calculation examples

The densities used in the following calculation examples vary according to temperature and pressure and may not be the appropriate densities to be used in the actual calculation.

Part 1 substance (single substance)

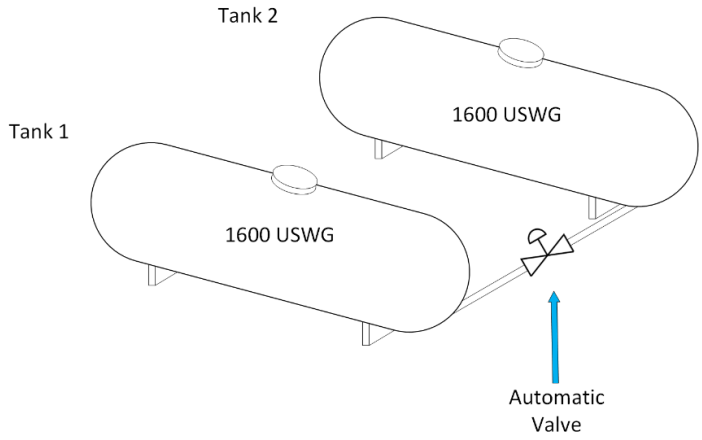
Example 1 – Propane (interconnected containers – automatic control valves)

Substance: Propane
Concentration: 100%
Density* @15C = 0.5066 g/cm^3

*Density value provided is for example purposes only. Density value of propane used in actual calculations should be based on on-site parameters (i.e. pressure, temp)

	USWG		
	Tank 1	**Tank 2**	**Piping**
Max. Capacity	2000	2000	10
Total Quantity	1600	1600	10

Container System Diagram Showing Total Quantity On-site (U.S. Gallons):



Propane in the E2 Regulations:

	Column 1	Column 2	Column 3	Column 4	Column 5
Sch 1 Item #	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
17[1]	74-98-6	Propane	1	4.5	E

[1] Substance found under Sch 1 – page 14

Maximum Capacity of Largest Container System:

- Substance makes the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1.
- Container systems are separated by automatic or remote values, not manual valves, so they are considered 2 separate container systems
- Use density of 0.5066 g/cm3 to determine maximum capacity of largest container system

1st container system (Tank 1 + ½ piping = 2000 USWG + 5 USWG):

$$2005\ US\ Gallons \times \frac{3.785\ Litres}{1\ US\ Gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{0.5066\ g}{1\ cm^3} \times \frac{1\ kg}{1\ 000\ g} \times \frac{1\ tonne}{1000\ kg} = 3.84\ tonnes$$

2nd container system (Tank 2 + ½ piping = 2000 USWG + 5 USWG):

$$2005\ US\ Gallons \times \frac{3.785\ Litres}{1\ US\ Gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{0.5066\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 3.84\ tonnes$$

The maximum capacity of the largest container system is 3.84 tonnes.

Total Quantity on Site:

1600 USWG + 1600 USWG + 10 USWG = 3210 USWG

$$3210\ US\ Gallons \times \frac{3.785\ Litres}{1\ US\ Gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{0.5066\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 6.16\ tonnes$$

The total quantity on site is 6.16 tonnes.

Schedules to fill out:

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Propane	3.84 < 4.5 No	6.16 ≥ 4.5 Yes	2

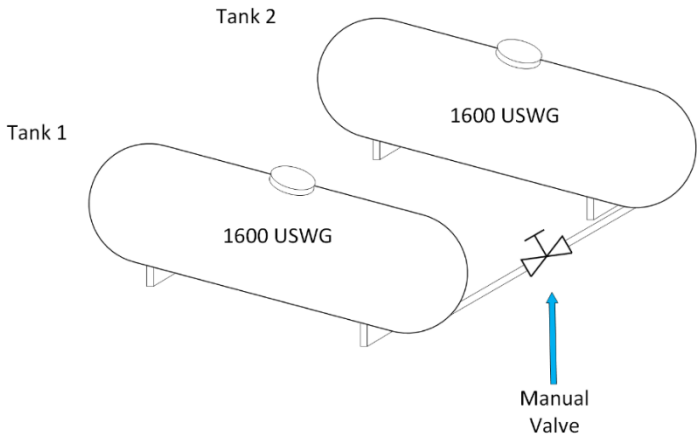
Example 2 – Propane (interconnected containers – manual valves)

Substance: Propane
Concentration: 100%
Density* @15C = 0.5066 g/cm^3

*Density value provided is for example purposes only. Density value of propane used in actual calculations should be based on on-site parameters (i.e. pressure, temp)

	USWG		
	Tank 1	**Tank 2**	**Piping**
Max. Capacity	2000	2000	10
Total Quantity	1600	1600	10

Container System Diagram Showing Total Quantity On-site (U.S. Gallons):



Propane in the E2 Regulations:

	Column 1	Column 2	Column 3	Column 4	Column 5
Sch 1 Item #	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
17[1]	74-98-6	Propane	1	4.5	E

[1] Substance found under Sch 1 – page 14

Maximum Capacity of Largest Container System:

- Substance makes the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1.
- Manual value does not distinguish between container systems. Therefore, this is considered to be one large container system.
- Use density of 0.5066 g/cm3 to determine maximum capacity of largest container system

1st container system (Tank 1 + Tank 2 + 1 pipe = 2000 USWG + 2000 USWG + 10 USWG):

$$4010\ US\ Gallons \times \frac{3.785\ Litres}{1\ US\ Gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{0.5066\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 7.69\ tonnes$$

The maximum capacity of the largest container system is 7.69 tonnes.

Total Quantity on Site:

1600 USWG + 1600 USWG + 10 USWG = 3210 USWG

$$3210\ US\ Gallons \times \frac{3.785\ Litres}{1\ US\ Gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{0.5066\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 6.16\ tonnes$$

The total quantity on site is 6.16 tonnes.

Schedules to fill out:

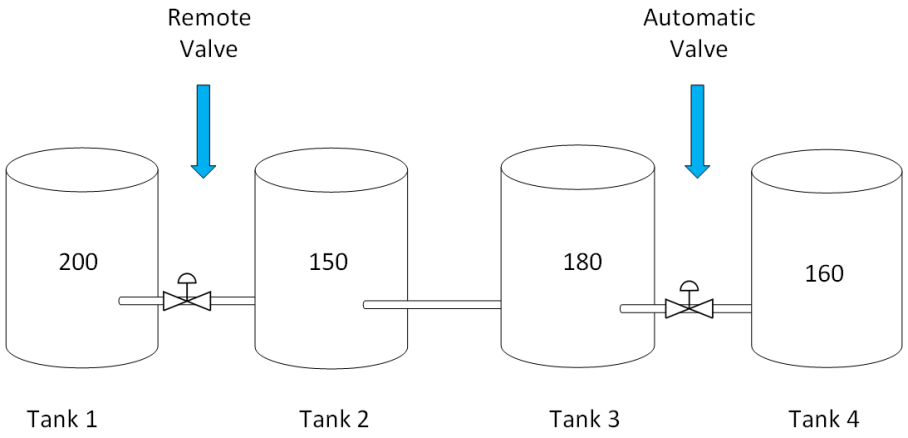
E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Propane	7.69 > 4.5 Yes	6.16 ≥ 4.5 Yes	2, 3, 4, 5

Example 3 – Cyclohexane

Substance: Cyclohexane
Concentration: 100%

	Tonnes				
	Tank 1	**Tank 2**	**Tank 3**	**Tank 4**	**Pipes**
Max. Capacity	250	250	250	250	0.215
Total Quantity	200	150	180	160	0.215

Container system diagram showing total quantity on-site (tonnes)



Cyclohexane in the E2 Regulations (Sch 1 – page 17)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
94[1]	110-82-7	Cyclohexane	1	550	C

[1] Substance found under Sch 1 – page 17

Considerations when determining the maximum capacity of the largest container system

- Substance exceeds the threshold set out in Column 3 in Part 1 of Schedule 1.
- Amount of substance that will need to be calculated for the maximum capacity within the largest container system.
- Containers are separated by automatic or remote valves.

Maximum capacity calculations

1st container system (Tank 1 + ½ pipe): 250 + ½ pipe (0.215) = 250.1075 tonnes

2nd container system (Tank 2 + Tank 3 + 1 pipe + two ½ pipes): 250 + 250 + 1.0 pipe (0.215) + 0.5 pipe (0.215) + 0.5 pipe (0.215) = 500.43 tonnes

3rd container system (Tank 4 + ½ pipe): 250 + ½ pipe (0.215) = 250.1075 tonnes

The maximum capacity of the largest container system is 500.43 tonnes.

Total quantity on-site calculation

200 + 150 + 180 + 160 + (3 x 0.215) = 690.645 tonnes

Schedules to fill out

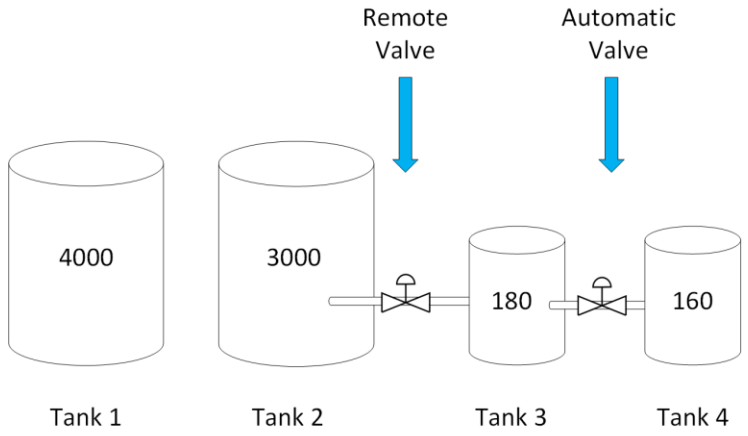
E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Cyclohexane	500.43 < 550 No	690.645 ≥ 550 Yes	2

Example 4 – Crude oil, oil sand

Substance: Crude oil, oil sand
Concentration: 100%

	Tonnes				
	Tank 1	**Tank 2**	**Tank 3**	**Tank 4**	**Pipes**
Max. Capacity	5000	4000	225	200	1
Total Quantity	4000	3000	180	160	1

Container system diagram showing total quantity on-site (tonnes)



Crude oil, oil sand in the E2 Regulations (Sch 1 – page 22)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
234[1]	128683-25-0	Crude oil, oil sands	1	2500	F

[1] Substance found under Sch 1 – page 22

Considerations when determining the maximum capacity of the largest container system

- Substance exceeds the threshold set out in Column 3 in Part 1 of Schedule 1.
- Amount of substance will need to be calculated for the maximum capacity within the largest container system.
- Container systems are separated by automatic or remote valves.

Maximum capacity calculations

1st container system (tank 1): 5000 tonnes

2nd container system (tank 2 + ½ pipe): 4000 + 0.5 = 4 000.5 tonnes

3rd container system (tank 3 + ½ pipe + ½ pipe) = 225 + 0.5 + 0.5 = 226 tonnes

4th container system (take 4 + ½ pipe) = 200 + 0.5 = 200.5 tonnes

The maximum capacity of the single largest container system is 5000 tonnes.

Total quantity on-site calculation

4000 + 3000 + 180 + 160 + (2 x 1) = 7342 tonnes

Schedules to fill out

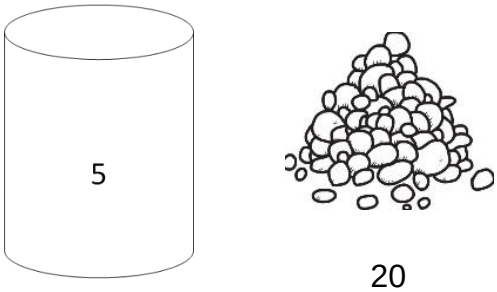
E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Crude oil, oil sand	5000 ≥ 2 500 Yes	7342 ≥ 2 500 Yes	2, 3, 4, 5

Example 5 – Uncontained and contained

Substance: Ammonium nitrate
Concentration: 100%

	Tonnes	
	Tank 1	**Uncontained**
Max. Capacity	10	20
Total Quantity	5	20

Diagram showing contained and uncontained total quantity on-site (tonnes)



Ammonium nitrate, solid in the E2 Regulations (Sch 1 – page 19)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
152[1]	6484-52-2	Ammonium nitrate, solid	60	20	O

[1] Substance found under Sch 1 – page 19

Maximum capacity of the largest container system

- Substance makes the concentration cut-off as shown in Column 3 in Part 2 of Schedule 1.
- An uncontained amount of ammonium nitrate, solid, is also present at the site.

Container system (tank 1): 10 tonnes
Uncontained: 20 tonnes

The maximum capacity of the single largest container system is 10 tonnes, but the amount of the substance in an uncontained state is 20 tonnes. Therefore, 20 tonnes will be reported as the maximum capacity.

Total quantity on-site
5 + 20 = 25 tonnes

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Ammonium nitrate, solid	20 ≥ 20 Yes	25 ≥ 20 Yes	2, 3, 4, 5

Part 1 substance (mixture)

Example 6 – Inhalation mixture

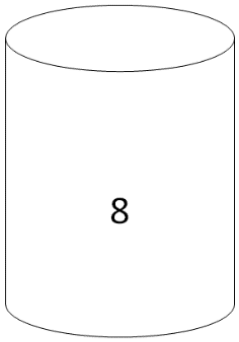
Substance: inhalation mixture with an overall vapour pressure of 3.33 kPa (No CAS # assigned to this mixture).

	Tonnes	
	Tank 1	**Pipes**
Max. Capacity	10	0
Total Quantity	8	0

Composition of tank

E2 Substance	% (by weight in tonnes)
Cyanogen bromide	60
Cyanogen chloride	40

Container system diagram showing total quantity on-site (tonnes)



Tank 1

Substances found within the inhalation mixture in the E2 Regulations (Sch 1 – page 18)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
119[1]	506-68-3	Cyanogen bromide	10	4.5	I
120[1]	506-77-4	Cyanogen chloride	10	4.5	I

[1] Substance found under Sch 1 – page 18

Maximum capacity of the largest container system

- All substances make the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1.

The largest container system has 10 tonnes.

Total quantity on-site calculation

The total quantity on-site is 8 tonnes. Each individual E2 substance will need to be calculated for the total quantity on-site.

E2 Substance	%	8 Tonnes x % (on-site)
Cyanogen bromide	60	4.8
Cyanogen chloride	40	3.2

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Cyanogen bromide	10 ≥ 4.5 Yes	4.8 ≥ 4.5 Yes	2, 3, 4, 5
Cyanogen chloride	10 ≥ 4.5 Yes	3.2 < 4.5 No	2

Example 7a – Mixture containing C and/or E substances

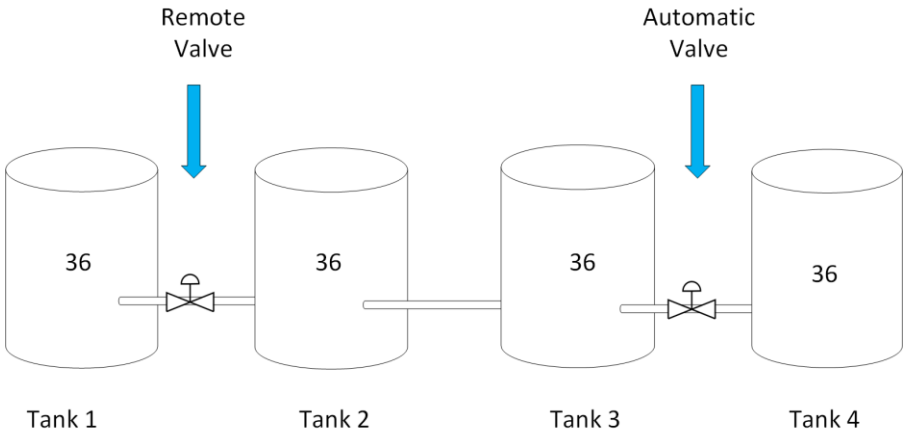
Substance: A mixture with an overall boiling point of 45 ºC and an overall flashpoint of 6 °C (No CAS # is assigned to this mixture)

	Tonnes				
	Tank 1	**Tank 2**	**Tank 3**	**Tank 4**	**Pipes**
Max. Capacity	45	45	45	45	0.1
Total Quantity	36	36	36	36	0.1

Composition of tanks

E2 Substance	**%**
Methane	30
Ethane	25
Propane	10
Styrene	25
Cyclopropane	9.4
Benzene	0.5
Xylenes	0.1

Container system diagram showing total quantity on-site (tonnes)



Substances found within the mixture from the E2 Regulations

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
7[1]	74-82-8	Methane	1	4.5	E
9[1]	74-84-0	Ethane	1	4.5	E
17[1]	74-98-6	Propane	1	4.5	E
60[3]	100-42-5	Styrene	1	4.5	E
28[2]	75-19-4	Cyclopropane	1	4.5	E
6[1]	71-43-2	Benzene	1	10	C
146[4]	1330-20-7	Xylenes	1	8000	C

[1] Substance found under Sch 1 – page 14
[2] Substance found under Sch 1 – page 15
[3] Substance found under Sch 1 – page 16
[4] Substance found under Sch 1 – page 19

Maximum capacity of the largest container system

- Not all substances make the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1. Benzene and xylene do not meet the cut-off concentration.
- Container systems are separated by automatic or remote valves, but not manual valves.

Maximum capacity calculations

1st container system (tank 1 + ½ pipe): 45 + ½ pipe (0.1) = 45.05 tonnes

2nd container system (tank 2 + tank 3 + 1 pipe + two ½ pipes): 45 + 45 + 1 pipe (0.1) + ½ pipe (0.1) + ½ pipe (0.1) = 90.2 tonnes

3rd container system (tank 4 + ½ pipe): 45 + ½ pipe (0.1) = 45.05 tonnes

The maximum capacity of the single largest container system is 90.2 tonnes.

Total quantity on-site calculations

Tank 1 + tank 2 + tank 3 + tank 4 + 3 pipes = 36 + 36 + 36 + 36 + (3 x 0.1) = 144.3 tonnes

Each individual E2 substance will need to be calculated for the total quantity on-site for that substance.

E2 Substance	%	144.3 Tonnes x % (on-site)
Methane	30	43.29
Ethane	25	36.08
Propane	10	14.43
styrene	25	36.08
Cyclopropane	9.4	13.56

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Methane	90.2 ≥ 4.5 Yes	43.29 ≥ 4.5 Yes	2, 3, 4, 5
Ethane	90.2 ≥ 4.5 Yes	36.08 ≥ 4.5 Yes	2, 3, 4, 5
Propane	90.2 ≥ 4.5 Yes	14.43 ≥ 4.5 Yes	2, 3, 4, 5
Styrene	90.2 ≥ 4.5 Yes	36.08 ≥ 4.5 Yes	2, 3, 4, 5
Cyclopropane	90.2 ≥ 4.5 Yes	13.56 ≥ 4.5 Yes	2, 3, 4, 5
Benzene	Concentration Not Met		None
Xylenes	Concentration Not Met		None

Example 7b – Mixture containing C and/or E substances (% range)

Substance: A mixture with an overall boiling point of 135 °C and an overall flashpoint of 20 °C (No CAS # is assigned to this mixture), with overall density of 882.5 kg/m^3.

	Tonnes
	Tank 1
Max. Capacity	25 000
Total Quantity	20 000

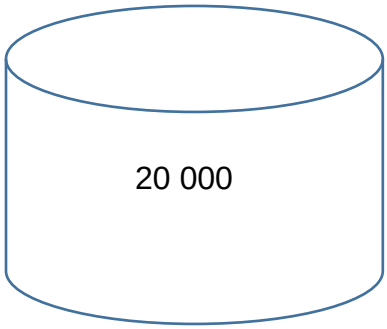
Composition of tanks and estimated calculation percentage

Substances	**%**	**Use highest % in range [e.g., (20 - 70), use 70]**	**Adjust to 100% (e.g., 70 ÷ 180 = 52.5%)**
Styrene	20 - 70	70	38.9
Toluene	30 - 60	60	33.3
Xylene	20 - 50	50	27.8
	Total =	**180**	**100.0%**

Substances and percentages that are recommended for use in calculations

E2 Substances	**%**
Styrene	38.9
Toluene	33.3
Xylene	27.8

Container system diagram showing total quantity on-site (tonnes)



Tank 1

Substances found within the mixture from the E2 Regulations

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	CAS Registry	Name of Substance	Concentration (% mass/mass)	Minimum Quantity (tonnes)	Hazard Category (Short Form)
60[1]	100-42-5	Styrene	10	4.5	E
83[2]	108-88-3	Toluene	1	2500	C
146[3]	1330-20-7	Xylene	1	8000	C

[1] Substance found under Sch 1 – page 16
[2] Substance found under Sch 1 – page 16
[3] Substance found under Sch 1 – page 19

Maximum capacity of the largest container system

- All substances make the concentration cut-off as shown in Column 3 in Part 2 of Schedule
- The largest container system is 25 000 tonnes

Total quantity on-site calculation

The total quantity on-site is 20 000 tonnes. Each individual E2 substance will need to be calculated for the total quantity on-site.

E2 Substances	%	20 000 tonnes x % (on site)
Styrene	38.9	7 780
Toluene	33.3	6 660
Xylene	27.8	5 560

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System vs E2 (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to Fill Out
Styrene	25 000 ≥ 4.5	7 780 ≥ 4.5	2, 3, 4, 5
Toluene	25 000 ≥ 2 500	6 660 ≥ 2 500	2, 3, 4, 5
Xylene	25 000 ≥ 8 000	5 560 < 8 000	2

Example 8 – Aquatic toxic mixture

Substance: An aquatically toxic mixture (No CAS # assigned to this mixture).

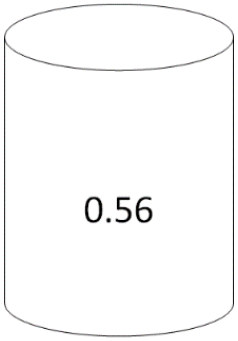
	Tonnes	
	Tank 1	Pipes
Max. Capacity	0.7	0
Total Quantity	0.56	0

Composition in the tank

Substances	%
Nickel(II) nitrate, hexahydrate	30
Nickel ammonium sulphate	25
Nickel nitrate	10
Nickel carbonate*	35

* This substance has been removed from the 2019 E2 Regulations

Container system diagram showing total quantity on-site (tonnes)



Tank 1

Substances found within the aquatic toxic mixture in the E2 Regulations

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
207[1]	13478-00-7	Nickel(II) nitrate, hexahydrate	10	0.22	A
208[1]	15699-18-0	Nickel ammonium sulphate	10	0.22	A
204[2]	13138-45-9	Nickel nitrate	10	0.22	A

[1] Substance found under Sch 1 – page 21
[2] Substance found under Sch 1 – page 20

Maximum capacity of the largest container system

- All the substances listed in Schedule 1 make the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1.

Maximum capacity calculation

The maximum capacity of the single largest container system is 0.7 tonnes.

Total quantity on-site

Only one tank – total quantity of mixture is 0.56 tonnes.

Each individual E2 substance will need to be calculated for the total quantity on-site for that substance.

E2 Substance	%	0.56 Tonnes x % (on-site)
Nickel(II) nitrate, hexahydrate	30	0.17
Nickel ammonium sulphate	25	0.14
Nickel nitrate	10	0.06

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Nickel(II) nitrate, hexahydrate	0.7 ≥ 0.22 Yes	0.17 < 0.22 No	2
Nickel ammonium sulphate	0.7 ≥ 0.22 Yes	0.14 < 0.22 No	2
Nickel nitrate	0.7 ≥ 0.22 Yes	0.06 < 0.22 No	2
Nickel carbonate	Not an E2 Substance		none

Example 9 – Mixture containing C and/or E substances (% range)

Substance: A mixture with an overall boiling point of 145 °C and an overall flashpoint of 20 °C (No CAS # is assigned to this mixture)

	Tonnes						
	Tank 1	Tank 2	Tank 3	Tank 4	Pipe 1	Pipe 2	Pipe 3
Max. Capacity	400	250	125	80	2	1	1
Total Quantity	300	200	100	50	2	1	1

Composition of tanks and estimated calculation percentage

Substances	**%**	**Use highest % in range [e.g., (30 - 100), use 100]**	**Adjust to 100% (e.g., 100 ÷ 190.5 = 52.5%)**
Propane	30 - 100	100	52.5
Methane	20 - 60	60	31.5
1,3-pentadiene, (*E*)-	10 - 15	15	7.9*
Toluene	5 - 10	10	5.2
Benzene	0.5 - 5	5	2.6
Xylene	0.1 – 0.5	0.5**	0.3
	Total =	**190.5 %**	**100.0%**

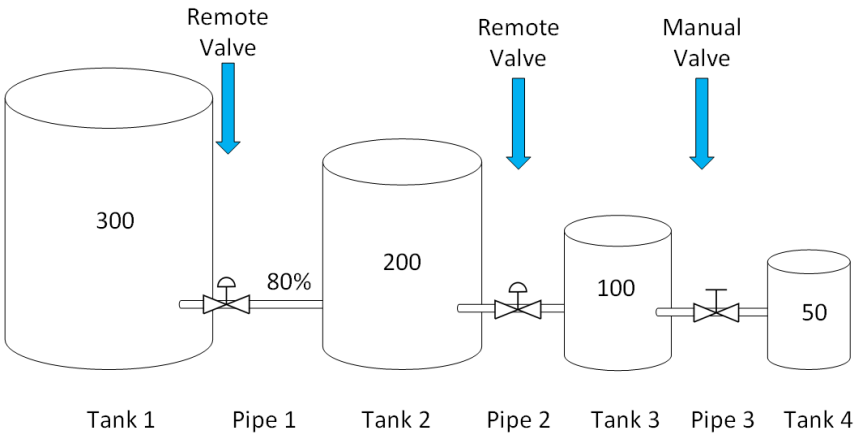
* Not an E2 substance (CAS #2004-70-8), will not be included in calculations

** Below concentration of Schedule 1 Column 3 concentration threshold for substance therefore not carried forward in the total quantity calculations

Substances and percentages that are recommended for use in calculations

E2 Substances	**%**
Propane	52.5
Methane	31.5
Toluene	5.2
Benzene	2.6

Container system diagram showing total quantity on-site (tonnes)



Substances found within the mixture from the E2 Regulations

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
17[1]	74-98-6	Propane	1	4.5	E
7[1]	74-82-8	Methane	1	4.5	E
83[2]	108-88-3	Toluene	1	2500	C
6[1]	71-43-2	Benzene	1	10	C
146[3]	1330-20-7	Xylenes	1	8000	C

[1] Substance found under Sch 1 – page 14
[2] Substance found under Sch 1 – page 16
[3] Substance found under Sch 1 – page 19

Maximum capacity of largest container system

- Not all substances make the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1. Xylene does not meet the cut-off concentration.
- Container systems are separated by automatic or remote valves, but not manual valves.

Maximum capacity calculations

1st container system (tank 1 + 20% pipe 1): 400 + 0.2 (2) = 400.4 tonnes

2nd container system (tank 2 + 80% pipe 1 + 50% pipe 2): 250 + 0.8(2) + 0.5 (1) = 252.1 tonnes

3rd container system (tank 3 + 0.5% pipe 2 + pipe 3 + tank 4) = 125 + 0.5(1) + 1 + 80 = 206.5 tonnes

The maximum capacity of the single largest container system is 400.4 tonnes.

Total quantity on-site

Tank 1 + tank 2 + tank 3 + tank 4 + 3 pipes = 300 + 200 + 100 + 50 + 2 + 1 + 1 = 654 tonnes

Each individual E2 substance will need to be calculated for the total quantity on-site for that substance.

E2 Substance	%	654 Tonnes x % (on site)
Propane	52.5	343.35
Methane	31.5	206.01
Toluene	5.2	34.01
Benzene	2.6	17.00

Schedules to fill out

E2 Substance	Meets Container System Site vs E2 (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules needed to be completed
Propane	400.4 ≥ 4.5 Yes	343.35≥ 4.5 Yes	2, 3, 4, 5
Methane	400.4 ≥ 4.5 Yes	206.01 ≥ 4.5 Yes	2, 3, 4, 5
Toluene	400.4 < 2 500 No	34.01 < 2 500 No	none
Benzene	400.4 ≥ 10 Yes	17.00 ≥ 10 Yes	2, 3, 4, 5
Xylenes	Concentration Not Met		None

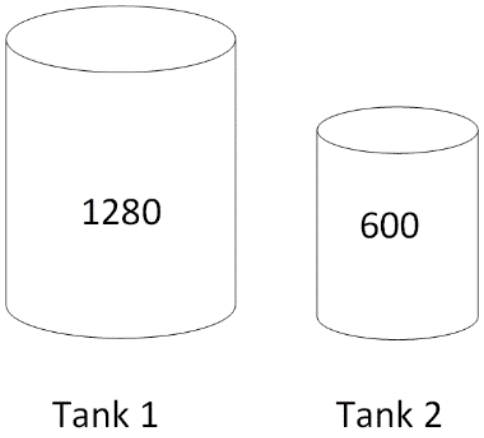
Part 2 substance (single substance, 2 tank systems, 2 substance concentrations)

Example 10 – Hydrochloric acid

Substance: Hydrochloric acid
Maximum capacity of individual tanks
Tank 1: Concentration: 40% with density: 1.198 g/cm^3
Tank 2: Concentration: 34% with density: 1.1691 g/cm^3

	Litres		
	Tank 1	**Tank 2**	**Pipes**
Max. Capacity	1600	800	0
Total Quantity	1280	600	0

Container system diagram showing total quantity on-site (litres)



Hydrochloric acid in the E2 Regulations (Sch 1 – page 22)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Total Quantity (tonnes)**	**Hazard Category (Short Form)**
7[1]	7647-01-0	Hydrochloric acid	30	6.8	I

[1] Substance found under Sch 1 – page 14

Maximum capacity of the largest container system

- Substance makes the concentration cut-off as shown in Column 3 in Part 2 of Schedule 1.

1st container system (tank 1)

$$tank\ 1 \times \frac{1600\ L}{tank\ 1} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.198\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 1.93\ tonnes$$

2nd container system (tank 2)

$$tank\ 2 \times \frac{800\ L}{tank\ 2} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.1691\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 0.94\ tonnes$$

The maximum capacity of the single largest container system is 1.93 tonnes.

Total quantity on-site calculation

$$tank\ 1 \times \frac{1280\ L}{tank\ 1} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.198\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.4 = 0.61\ tonnes$$

$$tank\ 2 \times \frac{600\ L}{tank\ 2} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.1691\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.34 = 0.24\ tonnes$$

Total quantity on-site: 0.61 + 0.24 = 0.85 tonnes

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Hydrochloric acid	1.93 < 6.80 No	0.85 < 6.80 No	none

Part 2 substance (mixture)

Example 11 – Mixtures containing C and/or E substance

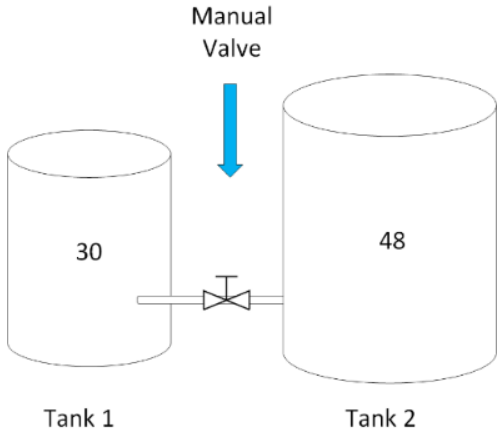
Substance: A mixture with an overall boiling point of 80 ºC and an overall flashpoint of -10 ºC (No CAS # assigned to this mixture)

	Tonnes		
	Tank 1	**Tank 2**	**Pipes**
Max. Capacity	50	60	1
Total Quantity	30	48	1

Composition of both tanks

E2 Substance	% (by Weight in Tonnes)
Naphtha	10
Methane	20
Propane	60
Benzene	5
2,2-dimethylpropane	5

Container system diagram showing total quantity on-site (tonnes)



Substances found within the mixture from the E2 Regulations

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
191[1]	8030-30-6	Naphtha	1	50	C
7[2]	74-82-8	Methane	1	4.5	E
17[2]	74-98-6	Propane	1	4.5	E
6[2]	71-43-2	Benzene	1	10	C
117[3]	463-82-1	2,2-dimethylpropane	1	4.5	E

[1] Substance found under Sch 1 – page 20
[2] Substance found under Sch 1 – page 14
[3] Substance found under Sch 1 – page 18

Maximum capacity of the largest container system

- All substances make the concentration cut-off as shown in Column 3 in Part 1 of Schedule 1.
- Container systems are separated by manual, but not automatic or remote, valves.

Tank #1 (50 tonnes) + Tank #2 (60 tonnes) + pipe = 50 tonnes + 60 tonnes + 1.0 tonnes = 111 tonnes

The maximum capacity of the single largest container system is 111 tonnes.

Total quantity on-site calculation

Tank #1 (30 tonnes) + Tank #2 (48 tonnes) + pipe (1 tonne)
= 30 tonnes + 48 tonnes + 1.0 tonnes = 79 tonnes

Each individual E2 substance will need to be calculated for the total quantity on-site.

E2 Substance	%	79 Tonnes x % (on-site)
Naphtha	10	7.9
Methane	20	15.8
Propane	60	47.4
Benzene	5	3.95
2,2-dimethylpropane	5	3.95

Schedules to fill out

E2 Substance	Meets Maximum Capacity of Largest Container System (tonnes)	Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Naphtha	111 ≥ 50 Yes	7.9 < 50 No	2
Methane	111 ≥ 4.5 Yes	15.8 ≥ 4.5 Yes	2, 3, 4, 5
Propane	111 ≥ 4.5 Yes	47.4 ≥ 4.5 Yes	2, 3, 4, 5
Benzene	111 ≥ 10 Yes	3.95 < 10 No	2
2,2-dimethylpropane	111 ≥ 4.5 Yes	3.95 < 4.5 No	2

Example 12 – Aquatic mixture with acids

Substance: An aquatically toxic mixture (No CAS # assigned to this mixture)

Tank 1 = Chromic acid 26% with density: 0.3172 g/cm^3 (15 °C)
Arsenic acid 30% with density: 0.3699 g/cm^3 (15 °C)

No density for mixture provided – will be required to calculate overall density as part of example.

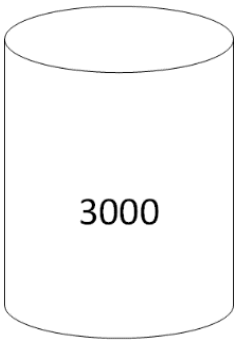
Composition in the tank

Substance	% (by volume)
Chromic Acid	26
Arsenic Acid	30
Water*	44

* not an E2 substance

	U.S. Gallons	
	Tank 1	Pipes
Max. Capacity	5000	0
Total Quantity	3000	0

Container system diagram showing total quantity on-site (U.S. gallons)



Tank 1

Substances found within the aquatic mixture in the E2 Regulations (page 22)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	CAS Registry Number	Name of Substance	Concentration (% mass/mass)	Minimum Quantity (tonnes)	Hazard Category (Short Form)
12[1]	7738-94-5	Chromic acid	10	0.22	A
13[1]	7778-39-4	Arsenic acid	10	0.22	A

[1] Substance found under Sch 1 – page 14

Maximum capacity of the largest container system

- Check: Every substance meets the concentration shown in Column 3.
- Must be converted from U.S. gallons to tonnes.

- Will need to calculate the overall density of the mixture to determine the tonnes using this formula:

$$Density\ \left(\frac{g}{cm^3}\right) = \frac{Mass\ (g)_{Chromic\ acid} + Mass\ (g)_{Arsenic\ acid} + Mass\ (g)_{water}}{Volume\ (cm^3)_{Total}}$$

- Use the density of water as 1.0 g/cm^3

Calculating mass and volume

Mass (g)$_{\text{Chromic acid}}$

$$5\ 000\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{0.3172\ g}{1\ cm^3} \times 0.26 = 1.56078 \times 10^6\ g$$

Mass (g)$_{\text{Arsenic acid}}$

$$5\ 000\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{0.3699\ g}{1\ cm^3} \times 0.3 = 2.10011 \times 10^6\ \text{g}$$

Mass (g)$_{\text{water}}$

$$5\ 000\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.0\ g}{1\ cm^3} \times 0.44 = 8.327 \times 10^6\ \text{g}$$

Volume (cm^3)$_{\text{Total}}$

$$5\ 000\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} = 1.8925 \times 10^7\ cm^3$$

Calculating the density of the overall solution

$$Density\ \left(\frac{g}{cm^3}\right) = \frac{Mass\ (g)_{Chromic\ acid} + Mass\ (g)_{Arsenic\ acid} + Mass\ (g)_{water}}{Volume\ (cm^3)_{Total}}$$

$$= \frac{1.56078 \times 10^6 + 2.10011 \times 10^6 + 8.327 \times 10^6}{1.8925 \times 10^7 cm^3} = 0.633442\ \frac{g}{cm^3}$$

Calculating the tonnage of maximum capacity of the largest single container system

$$5\ 000\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{0.633442\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg}$$
$$= 11.99\ tonnes$$

The maximum capacity of the single largest container system is 11.99 tonnes.

Total quantity on-site

Each individual E2 substance will need to be calculated for the total quantity on-site.

Chromic acid total quantity on-site

$$1\ tank \times \frac{3000\ US\ gallons}{1\ tank} \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{0.3172\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.26 = 0.94\ tonnes$$

Arsenic acid total quantity on-site

$$1\ tank \times \frac{3000\ US\ gallons}{1\ tank} \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{0.3699\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.3 = 1.26\ tonnes$$

E2 Substance	%	Tonnes (on-site)
Chromic acid	26	0.94
Arsenic acid	30	1.26

Schedules to fill out

E2 Substance	Meets Container System Site vs E2 (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Chromic acid	11.99 ≥ 0.22 Yes	0.94 ≥ 0.22 Yes	2, 3, 4, 5
Arsenic acid	11.99 ≥ 0.22 Yes	1.26 ≥ 0.22 Yes	2, 3, 4, 5

Example 13 – Inhalation mixture with acids

Substance: An inhalation toxic mixture (No CAS # assigned to this mixture)

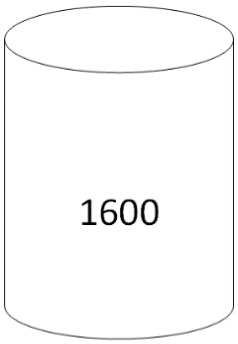
Tank 1 = Acetic acid 95% with density: 1.00748 g/cm^3 (20 °C)
Peracetic acid 5% with density: 1.15 g/cm^3 (20 °C)
Overall density of mixture = 1.0146 g/cm^3

Composition in the tank

E2 Substance	% (by volume)
Acetic Acid	95
Peracetic Acid	5

	U.S. Gallons	
	Tank 1	Pipes
Max. Capacity	2 000	0
Total Quantity	1 600	0

Container system diagram showing total quantity on-site (U.S. gallons)



Tank 1

Substances found within the inhalation mixture in the E2 Regulations (page 22)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	CAS Registry Number	Name of Substance	Concentration (% mass/mass)	Minimum Quantity (tonnes)	Hazard Category (Short Form)
2[1]	64-19-7	Acetic acid	95	6.80	A
4[1]	79-21-0	Peracetic acid	10	4.50	A

[1] Substance found under Sch 1 – page 22

Maximum capacity of the largest container system

- Use density of 1.0146 g/cm^3 to determine maximum capacity of largest container system

$$2\,000\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.0146\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg}$$
$$= 7.68\ tonnes$$

The maximum capacity of the single largest container system is 7.68 tonnes.

Total quantity on-site

- Peracetic acid is below the concentration and will not be considered in the calculations.

Acetic acid (95%) total quantity on-site

$$1\,600\ US\ gallons \times \frac{3.785\ L}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ L} \times \frac{1.00748\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.95$$
$$= 5.80\ tonnes$$

E2 Substance	%	Tonnes (on-site)
Acetic acid	95	5.80

Schedules to fill out

E2 Substance	Meets Container System Site vs E2 (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Acetic acid	7.68 ≥ 6.80 Yes	5.80 < 6.80 No	2
Peracetic acid	Did Not Meet Concentration		None

Example 14 – Inhalation mixture with acids

Tank 1 and Tank 2 = Nitric acid 13% with density 1.072 g/cm^3 (20 °C)
Hydrochloric acid 40% with density 1.198 g/cm^3 (20 °C)
No density for mixture provided – will be required to calculate overall density as part of example

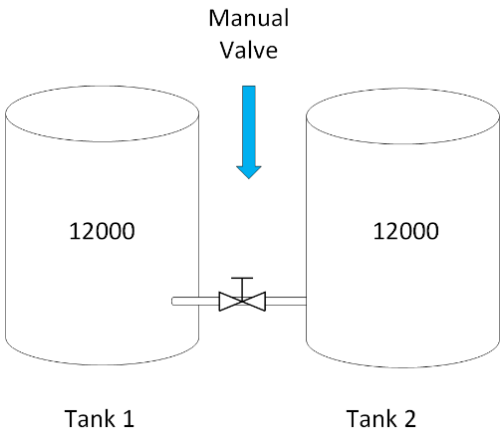
Composition in the tank

E2 Substance	% (by volume)
Nitric Acid	13
Hydrochloric Acid	40
Water*	47

* Not an E2 substance

	Litres		
	Tank 1	Tank 2	Pipes
Max. Capacity	20 000	20 000	20
Total Quantity	12 000	12 000	20

Container system diagram showing total quantity on-site (litres)



Substances found within the inhalation mixture in the E2 Regulations (page 22)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
7[1]	7647-01-0	Hydrochloric acid	30	6.80	I
10[1]	7697-37-2	Nitric acid	80	6.80	I

[1] Substance found under Sch 1 – page 22

Maximum capacity of the largest container system

- Check: Every substance meets the concentration shown in Column 3.
- Manual valve does not distinguish between container systems. Therefore, this is considered to be one large container system.
- Will need to calculate the overall density of the mixture to determine the tonnes using this formula:

$$Density\ \left(\frac{g}{cm^3}\right) = \frac{Mass\ (g)_{Nitric\ acid} + Mass\ (g)_{Hydrochloric\ acid} + Mass\ (g)_{water}}{Volume\ (cm^3)_{Total}}$$

- Use the density of water as 1.0 g/cm^3
- Total volume in litres is 20 000 + 20 000 + 20 = 40 020 litres

Calculating mass and volume

Mass (g)$_{\text{Nitric acid}}$

$$40\ 020\ litres \times \frac{1000\ cm^3}{1\ L} \times \frac{1.072\ g}{1\ cm^3} \times 0.13 = 5.57719 \times 10^6 g$$

Mass (g)$_{\text{Hydrochloric acid}}$

$$40\ 020\ litres \times \frac{1000\ cm^3}{1\ L} \times \frac{1.198\ g}{1\ cm^3} \times 0.4 = 1.91776 \times 10^7 \text{g}$$

Mass (g)$_{\text{water}}$

$$40\ \ 020\ litres \times \frac{1000\ cm^3}{1\ L} \times \frac{1.0\ g}{1\ cm^3} \times 0.47 = 1.88094 \times 10^7 \text{g}$$

Volume (cm^3)$_{\text{Total}}$

$$40\ \ 020\ litres \times \frac{1000\ cm^3}{1\ L} = 4.002 \times 10^7 cm^3$$

Calculating the density of the overall solution

$$Density\ \left(\frac{g}{cm^3}\right) = \frac{Mass\ (g)_{Nitric\ acid} + Mass\ (g)_{Hydrochloric\ acid} + Mass\ (g)_{water}}{Volume\ (cm^3)_{Total}}$$

$$= \frac{5.57719 \times 10^6 + 1.91776 \times 10^7 + 1.88094 \times 10^7}{4.002 \times 10^7 cm^3} = 1.08856 \frac{g}{cm^3}$$

Calculating the tonnage of the maximum capacity of the largest single container system

$$40\ 020\ litres \times \frac{1000\ cm^3}{1\ L} \times \frac{1.08856\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} = 43.56\ tonnes$$

The maximum capacity of the single largest container system is 43.56 tonnes.

Total quantity on-site

- Nitric acid does not reach the concentration specified in Column 3 of Part 2 and therefore is not considered a substance under the E2 Regulations. Nitric acid will not be used in the calculations below.

There are two tanks and one pipe between the tanks.
The total quantity is 12 000 L + 12 000 L + 20 L = 24 020 L

Hydrochloric acid (40%) total quantity on-site

$$24\ 020\ litres \times \frac{1000\ cm^3}{1\ Litre} \times \frac{1.198\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.40 = 11.51\ tonnes$$

E2 Substance	%	Tonnes (on-site)
Hydrochloric acid	40	11.51

Schedules to fill out

E2 Substance	Meets Container System Site vs E2 (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Hydrochloric acid	43.56 ≥ 6.80 Yes	11.51 ≥ 6.80 Yes	2, 3, 4, 5
Nitric acid	Concentration Not Met		None

Example 15 – Inhalation mixture with acids

Tank 1, Tank 2 and Tank 3 all contain:

Hydrochloric acid at 30% (v/v) at 20 °C has a density of 1.1493 g/cm^3

Hydrofluoric acid at 60% (v/v) at 0 °C has a density of 1.235 g/cm^3

Hydrobromic acid at 10% (v/v) at 25 °C has a density of 1.728 g/cm^3

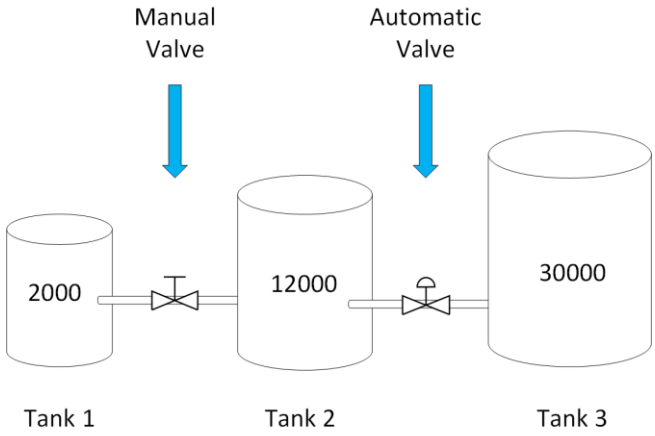
Density of solution = 1.2586 g/cm^3

Composition in the tank

E2 Substance	% (U.S. Gallons by Volume)
Hydrochloric acid	30
Hydrofluoric acid	60
Hydrobromic acid	10

	U.S. Gallons			
	Tank 1	Tank 2	Tank 3	Pipes
Max. Capacity	2500	15 000	37 500	100
Total Quantity	2000	12 000	30 000	100

Container system diagram showing total quantity on-site (U.S. gallons)



Substances found within the inhalation mixture in the E2 Regulations (page 22)

	Column 1	Column 2	Column 3	Column 4	Column 5
Item	**CAS Registry Number**	**Name of Substance**	**Concentration (% mass/mass)**	**Minimum Quantity (tonnes)**	**Hazard Category (Short Form)**
7	7647-01-0	Hydrochloric acid	30	6.80	I
8	7664-39-3	Hydrofluoric acid	50	0.45	I
15	10035-10-6	Hydrobromic acid	10	1.13	I

Maximum capacity of the largest container system

- All substances make the concentration cut-off as shown in Column 3 in Part 2 of Schedule 1.
- Container systems are separated by automatic or remote valves, but not manual valves.

Maximum capacity calculations

1st container system (tank 1 + tank 2 + 1 pipe + ½ pipe): 2 500 + 15 000 + 1 pipe (100) + ½ pipe (100) = 17 650 U.S. Gallons

2nd container system (tank 3 + ½ pipe): 30 000 + ½ pipe (100) = 30 050 U.S. Gallons

The largest container system has 30 050 U.S. Gallons. Convert this value to tonnes.

$$30\ 050\ US\ gallons \times \frac{3.785\ litres}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ litre} \times \frac{1.2586\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg}$$
$$= 143.15\ tonnes$$

The maximum capacity of the single largest container system is 143.15 tonnes.

Total quantity on-site

Tank 1 + tank 2 + tank 3 + 2 pipes = 2000 + 12 000 + 30 000 + 2 pipes (each 100) = 44 200 U.S. gallons

Each individual E2 substance will need to be calculated for the total quantity on-site.

Hydrochloric acid

$$44\ 200\ US\ gallons \times \frac{3.785\ litres}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ liter} \times \frac{1.1493\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.3$$
$$= 57.68\ tonnes$$

Hydrofluoric acid

$$44\ 200\ US\ gallons \times \frac{3.785\ litres}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{1.235\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.6$$
$$= 123.97\ tonnes$$

Hydrobromic acid

$$44\ 200\ US\ gallons \times \frac{3.785\ litres}{1\ US\ gallon} \times \frac{1000\ cm^3}{1\ Litre} \times \frac{1.728\ g}{1\ cm^3} \times \frac{1\ kg}{1000\ g} \times \frac{1\ tonne}{1000\ kg} \times 0.1$$
$$= 28.91\ tonnes$$

E2 Substance	%	Tonnes (on-site)
Hydrochloric acid	30	57.68
Hydrofluoric acid	60	123.97
Hydrobromic acid	10	28.91

Schedules to fill out

E2 Substance	Meets Container System Site vs E2 (tonnes)	Meets Total Quantity On-site vs E2 (tonnes)	Schedules to fill out
Hydrochloric acid	143.15 ≥ 6.80 Yes	57.68 ≥ 6.80 Yes	2, 3, 4, 5
Hydrofluoric acid	143.15 ≥ 0.45 Yes	123.97 ≥ 0.45 Yes	2, 3, 4, 5
Hydrobromic acid	143.15 ≥ 1.13 Yes	28.91 ≥ 1.13 Yes	2, 3, 4, 5

APPENDIX 5

Additional Guidance on Exclusions

Sections 2 and 3 of the E2 Regulations contain exclusions for certain substances. The exclusions in Section 2 are substance exclusions, and the ones in Section 3 are quantity exclusions. The following details the differences between the two types of exclusions and provides additional details on how they are applied.

Section 2 - Substance Exclusions

Although a chemical may be identified by a CAS# in Schedule 1 of the E2 Regulations, if it meets any of the criteria listed in sections 2(2)(a) to 2(2)(j) of the E2 Regulations, it is not considered to be a regulated substance. Therefore, when any of the exemptions in Section 2 of the E2 Regulations apply to a facility:

- The amount of the excluded chemical need not be considered in the determination of the maximum expected quantity of that substance onsite; and
- There is no need to submit a verbal or written report in the event of any accidental releases of that specific chemical under Section 18 of the E2 Regulations. Please note that other reporting requirements may exist under other pieces of legislation or by a different jurisdiction (i.e., Provincial/Territorial/Municipal).

For example, Facility A expects to have a maximum quantity of 20 tonnes of propane onsite in a given year. Propane is identified by a CAS# in Schedule 1 of the E2 Regulations, and is normally considered to be a regulated substance. Of that 20 tonnes of propane, 16 tonnes are regulated under the Transportation of Dangerous Goods Act, and therefore meet the exclusion criteria in section 2(2)(d) of the E2 Regulations. The maximum expected quantity of propane for the site is therefore calculated as:

20 tonnes – 16 tonnes (excluded amount) = ***4 tonnes***

Since 4 tonnes is lower than the quantity threshold of 4.5 tonnes for propane, there is no requirement for the submission of a notice under Schedule 2. If an accidental release of any propane that is covered by the exclusion occurs, there is no need to report under the E2 Regulations If an accidental release of any propane that is ***not*** covered by the exclusion occurs, both a verbal and written report are required under Section 18 of the E2 Regulations.

2(2)(a) – Substances that are Combustible (Hazard Category C) or an Explosion Hazard Category (E)

The exclusion reads as follows:

> *A substance that is identified in column 5 of Part 1 of Schedule 1 as combustible or likely to explode and*
>
> *i) Is in a mixture that has a flashpoint greater than 23 ºC and a boiling point greater than 35 ºC, or*

In order to determine whether or not this exclusion applies to a substance, a regulatee must identify the substance by its CAS# in column 1 of Schedule 1 of the E2 Regulations. Once this is done, the associated hazard category listed in column 5 needs to be assessed. Only substances with hazard categories of either combustible (C) or explosion hazard (E) are eligible for this exclusion.

It must then be determined whether or not the substance is contained in a mixture with a flashpoint is greater than 23 °C ***and*** a boiling point that is greater than 35 °C. If both criteria are met, the exclusion applies, but only to the quantity of the substance that is contained in the mixture. If the substance is stored elsewhere onsite, those quantities would not excluded from the E2 Regulations (unless the same criteria apply).

ii) Is a component of natural gas in its gaseous form;

Liquefied Natural Gas is identified in Schedule 1 of the E2 Regulations. Natural gas, in its gaseous form, also has the same CAS#, but is present in a gaseous phase. The gaseous form of Natural Gas is not regulated. This exclusion also prevents any of the ingredients of Natural Gas, for example methane, from indirectly causing Natural Gas to become subject to the E2 Regulations.

2(2)(b) – Inhalation Hazards Present in a Mixture with a Vapour Pressure of Less Than 1.33kPa

The exclusion reads as follows:

> *A substance that is identified in column 5 of Part 1 or 2 of Schedule 1 as an inhalation hazard and is in a mixture, in gaseous or liquid form, that has a total vapour pressure of less than 1.33 kPa*;

In order to ascertain whether or not this exclusion applies to a substance, the regulatee must identify the substance by CAS# in column 1 of Schedule 1 of the E2 Regulations. Once this is done, the associated hazard category listed in column 5 needs to be assessed. Only substances with the hazard category of inhalation hazard (I), ***and*** which are present in a mixture, may be eligible for this exclusion.

If the mixture has a total vapour pressure of less than 1.33 kPa, then the substance is not subject to the E2 Regulations. (This information should be available from the SDS.) This exclusion applies only to the quantity of the substance that is in a mixture that meets the vapour pressure criteria. If the substance is stored elsewhere onsite, those quantities would not excluded from the E2 Regulations (unless the same criteria apply).

2(2)(c) – Fuels used for Heating Fuels or Power Generation

The exclusion reads as follows:

> *A substance that is used to fuel a heating appliance or to generate power at the facility where it is located and is present in a quantity that is less than the quantity set out in column 4 of Part 1 of Schedule 1 for that substance;*

The intent of this exclusion is to exempt relatively small quantities of fuels that are used to generate power at a facility or to fuel an appliance used for heating purposes. There is no differentiation as to how the heating appliance is used - it may be to heat the surrounding air, water, wood chips, seeds, a cooking surface, etc. However, container systems storing fuel that is used for mixed purposes are not eligible for the exemption, even if one of those purposes is heating or power generation.

For this exclusion to apply, the total quantity of the substance on site must be less than the threshold quantity listed in Schedule 1 under column 4 of the E2 Regulations. Furthermore, the quantity of the substance must be used at the facility and not transferred to another facility.

For example, Facility B has three two tonne propane tanks onsite that are used to provide heat to three separate buildings. Although the propane is held in container systems whose capacity is less than the quantity threshold of 4.5 tonnes, the total amount of propane onsite is 6 tonnes, which exceeds the threshold criteria. Therefore, the exemption does not apply. If the facility only had two tanks, the total quantity onsite would be 4 tonnes, and the exemption ***would*** apply. Other examples are provided in the following table:

Table 5. Examples of Fuel Exclusions

Scenario Description	Excluded (Y/N)	Comments
1. A residential house with a 4 tonnes of heating oil (diesel) in a single tank used to heat the airspace in the house	*Y*	Heats inhabited airspace and less than schedule 1 threshold of 2500 tonnes
2. A hospital with 4 tonnes of propane in a tank system used to power a back-up generator	Y	Fuels a generator and is less than the schedule 1 threshold of 4.5 tonnes
3. A mine site with 4 tonnes of propane in a tank system that is used to heat a building airspace and also on the same site, 4 tonnes of propane in a tank system used for drying raw materials in the mine process	N	Total quantity onsite is 8 tonnes > Schedule 1 threshold (4.5 tonnes)

Scenario Description	Excluded (Y/N)	Comments
4. An oil and gas workers camp where there are two totally segregated tank systems with 3 tonnes of propane in each tank system and they are hooked up to heat airspace in two bunkhouses. There is also a 4 tonne diesel tank hooked up to a generator powering the camp kitchen.	N – propane, Y - diesel	Propane total quantity onsite is 6 tonnes > Schedule 1 threshold (4.5 tonnes). Diesel fuels a generator and is < Schedule 1 threshold of 2500 tonnes
5. A restaurant with 4 tonnes of propane in a tank system used to heat inhabited airspace and for cooking purposes.	Y	Dual purpose for the same substance, but both are used for heating purposes. Quantity is less than the threshold of 4.5 tonnes.
6. A residential house with 4 tonnes of heating oil (diesel) used to heat hot water in the boiler, which is used to heat the house through water baseboard heaters and is also used for general hot water purposes.	Y	Dual purpose for the same substance, but both are used for heating purposes.
7. A trailer park consisting of 50 mobile homes. Every mobile home stores 100 kg of propane used for heating airspace. The lots are leased from the trailer park, but the mobile homes and propane are privately owned.	Y	Used to heat inhabited airspace and 100kg < Schedule 1 threshold (4.5 tonnes) A responsible person is any person who owns or has the charge management or control of a substance that is located at a facility. In this case the individual mobile home owner is the responsible person (not the trailer park manager), therefore each lot is treated as a separate facility.

2(2)(d) – Substances Regulated under the Transportation of Dangerous Goods Act or the Canada Shipping Act

The exclusion reads as follows:

> *A substance that is regulated under the Transportation of Dangerous Goods Act, 1992 or the Canada Shipping Act, 2001;*

Any substance that is regulated under either the Transportation of Dangerous Goods Act, 1992, or the *Canada Shipping Act, 2001*, is exempt from the E2 Regulations, regardless of the quantity or length of time it is stored at a facility. Once these Acts no longer apply to the substance, the E2 Regulations become applicable. It is incumbent on the responsible person to know whether or not the substances for which they have care and control are subject to these Acts. If there is any doubt, Transport Canada can be contacted for assistance.

2(2)(e) – Substances Regulated under the National Energy Board Regulations

The exclusion reads as follows:

> *A substance that is in a pipeline that is regulated under the National Energy Board Onshore Pipeline Regulations or in a processing plant that is regulated under the National Energy Board Processing Plant Regulations;*

If a substance is in a pipeline or processing plant that is regulated under the associated National Energy Board Regulations, it is exempt from the E2 Regulations.

Under the Canada Energy Regulator Act, which enables the Onshore Pipeline Regulations and the Processing Plant Regulations, the definition of pipeline is very broad and includes all the related pump stations, compressor stations, etc. Therefore, this exclusion includes the pipeline and infrastructure at a processing plant, provided the substance is still in transportation. A storage tank within the pipeline transmission system is not covered under this exemption.

2(2)(f) – Substances in Provincial Pipelines

The exclusion reads as follows:

> *A substance that is in a pipeline located entirely within a province and that is on a property where there are no fixed onshore installations other than pipelines, compressor stations or pump stations;*

A substance in a pipeline that is within the boundaries of a facility is subject to the E2 Regulations. Once the pipeline leaves the property boundaries, the E2 Regulations no longer apply to the substance in the pipeline, provided the only fixed onshore installations are comprised of pipelines, compressor stations, or pump stations.

For example, Facility C, which processes petroleum, is situated on a very large property that is divided by a highway. A pipeline containing a regulated substance runs underneath the highway from one building at the facility, to another building, which is located on the other side of the highway. In this situation, the quantity of the substance in the length of the pipeline located between the property boundaries is excluded from the E2 Regulations, i.e., the portion leaving the property boundary where the first building is located, until it enters the property boundary where the second building is located.

2(2)(g) – Substance that is in a Fuel Tank

The exclusion reads as follows:

> *A substance that is in a fuel tank that is connected* to and supplies the engine of *a conveyance that is used for transportation*;

This exclusion is meant to capture the amount of fuel stored in vehicles used for transportation, such as trucks and cars.

2(2)(h) – Naphthalene in its Solid Form

The exclusion reads as follows:

> *The substance set out in item 57 of Part 1 of Schedule 1, if it is in a solid form*;

This exclusion applies to naphthalene, in its solid form. Naphthalene in its liquid form and/or gaseous form is subject to the E2 Regulations.

2(2)(i) – Nickel Oxide

The exclusion is worded as follows:

> *The substance set out in item 143 of Part 1 of Schedule 1, if it is in the form of solid particles that measure more than 10 µm in diameter;*

This exclusion applies to nickel oxide when it is in the form of particles that have a diameter greater than ten micrometres. When the diameter of the particles are less than 10 µm this becomes an inhalation hazard and is subject to the E2 Regulations.

2(2)(j) – Phosphorus

The exclusion is worded as follows:

> *The substance set out in item 167 of Part 1 of Schedule 1, if it is in a form other than white phosphorous*.

This exclusion applies to any form of phosphorus, with the exception of white phosphorus.

Section 3 - Quantity Exclusions

If a substance stored onsite meets any of the criteria listed in sections 3(2)(a) to 3(2)(e) of the E2 Regulations, it is still defined as an E2 substance, but the excluded quantity need not be considered in the determination of the maximum expected quantity of that substance onsite. Both verbal and written reporting requirements under Section 18 of the E2 Regulations for accidental releases still apply.

3(2)(a) – Substances at a Facility for 72 Hours or Less

The quantity exclusion reads as follows:

> *Quantities of the substance that are located at the facility for a period of 72 hours or less, unless the substance is loaded or unloaded at the facility, if, during that period, the person keeps evidence of the date and time at which the quantities of the substance arrived at the facility.*

This exclusion applies to the quantities of a regulated substance that are stored at a facility for up to 72 hours, provided they are not loaded or unloaded at the site. As soon as a substance is loaded or unloaded, the exclusion no longer applies. A facility claiming this exclusion must keep a record of the date, time, and quantity of each arrival of the substance at the site.

Please note, that substances eligible for this exclusion may also be regulated under the Transportation of Dangerous Goods Act, or the Canada Shipping Act. If that is the case, the substance exclusion under section 2(2)(d) should be applied instead.

For example, Facility D is expected to have a maximum quantity of 5000 tonnes of diesel fuel onsite over the course of a year. Diesel fuel is identified by a CAS# in Schedule 1 of the E2 Regulations, and is a regulated substance. Of the 5000 tonnes of diesel fuel expected to be onsite, 3000 tonnes will only be onsite for less than 72 hours, and no loading or unloading will occur. Therefore, the exclusion in section 3(2)(a) of the E2 Regulations applies.

As a result, the ***maximum expected quantity*** of diesel fuel is calculated to be:

5000 tonnes – 3000 tonnes (excluded quantity) = ***2000 tonnes***

Since 2000 tonnes is lower than the quantity threshold of 2500 tonnes for diesel fuel,

there is no requirement for the submission of a notice under Schedule 2. If an accidental release of ***any*** diesel fuel onsite occurs, both verbal and written report are required under Section 18 of the E2 Regulations.

3(2)(b) – Maximum Capacity of a Container System

The quantity exclusion reads as follows:

> *Quantities of the substance that are in a container system that has a maximum capacity of 0.03 t or less;*

The intent of this exclusion is to prevent household items from being captured by the E2 Regulations. If the maximum capacity of a container system in which a substance is stored is less than 30 kg, then the quantity of that substance is exempt from the E2 Regulations.

For example, Facility E has a total quantity of 1000 tonnes of ammonium nitrate (in solid form) onsite. The ammonium nitrate is packed in bags of 450 kg and 25 kg, which are then stored together in containers that have a maximum capacity of 115 tonnes (exceeding the quantity set out in column 3 of Schedule 1 for that substance). In this situation, the container system is considered to be the bag. Therefore, the quantity of the ammonium nitrate stored in the 25 kg bags would be excluded from the calculation of the maximum expected quantity of the substance onsite, but the quantity stored in the 450kg bags would not. If an accidental release of ***any*** of the substance onsite occurs, both verbal and written report are required under Section 18 of the E2 Regulations.

3(2)(c) – Solid Residues

The quantity exclusion reads as follows:

> *Quantities of the substance that are found in slag, waste rock, tailings, solid residues, ores and ore concentrates;*

If a substance identified in Schedule 1 of the E2 Regulations is found in a solid form such as slag, waste rock, tailing, solid residues, or ores and ore concentrates, then that quantity of the substance is excluded from the calculation of the maximum expected quantity of the substance onsite. If an accidental release of ***any*** of the substance onsite occurs, both verbal and written report are required under Section 18 of the E2 Regulations.

3(2)(d) - Propane

The quantity exclusion reads as follows:

> *Quantities of the substance set out in item 17 of part 1 of Schedule 1 that are in a container system that has a maximum capacity of less than 10 t and is located at least 360 m from all points along the boundary of the facility;*

In order to determine if this exemption applies to a facility, the regulatee must calculate the maximum capacity of the container system(s) onsite that hold propane. Instructions on how to do this can be found in Appendix 3 of this document. If the maximum capacity of the container system is 10 tonnes or more, the exclusion does not apply to the quantity of the propane stored in that container system.

If the maximum capacity of the container system is less than 10 tonnes, the regulatee must then measure the distance from the edge of the container system to ***all*** points along the site boundary of the facility. If at ***any*** point, the distance is less than 360 metres, the exemption does not apply to the quantity of propane stored in that container system.

If the container system meets the exclusion criteria, then the quantity of the substance stored within that container is excluded from the calculation of the maximum expected quantity of the substance onsite. If an accidental release of ***any*** of the substance onsite occurs, both verbal and written report are required under Section 18 of the E2 Regulations. A flowchart to help with the determination of this exemption can be found in Figure 1 on the following page.

3(2)(e) – Agricultural Nutrients

The quantity exclusion reasds as follows:

> *Quantities of a substance set out in item 163 of Part 1 of Schedule 1 or item 5 or 9 of Part 2 of that Schedule that are located at a farming operation for on-site use as an agricultural nutrient*

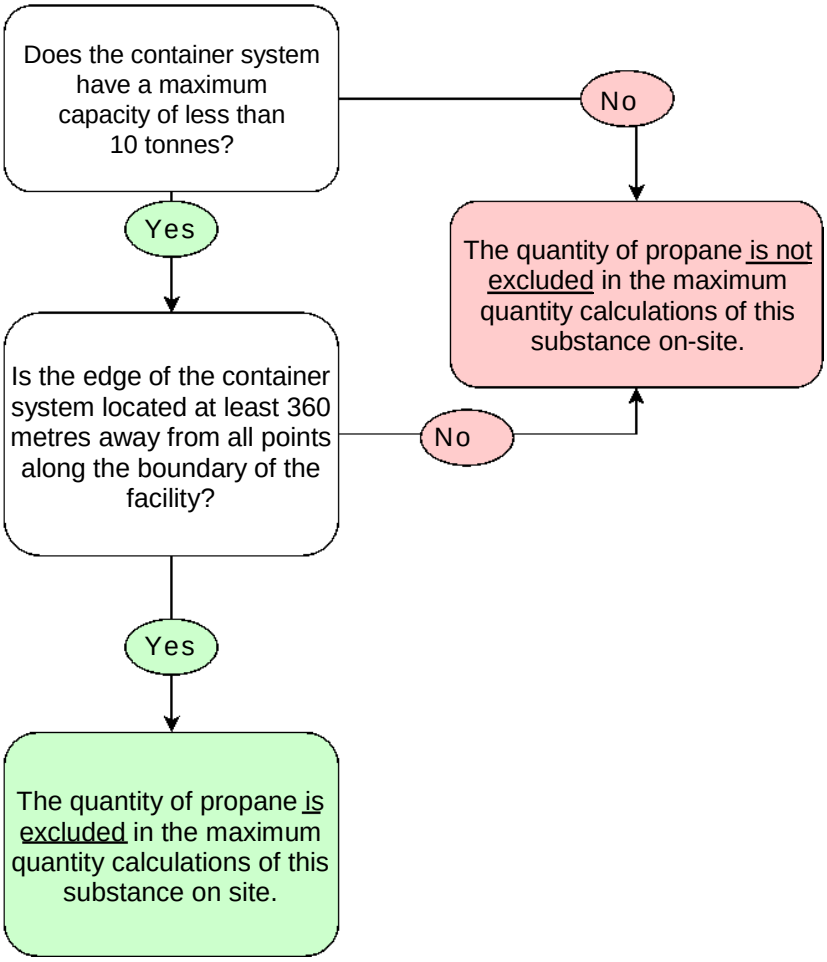
This exclusion applies to: anhydrous ammonia, ammonium hydroxide, and/or ammonia solution that is used as an agricultural nutrient at a farming operation. The nutrient(s) must be used at the site at which they are located. If these substances are stored for retail distribution, or for use at other farming opertions, the exclusion does not apply. If an accidental release of ***any*** of the substance onsite occurs, both verbal and written report are required under Section 18 of the E2 Regulations.

Step 1

Determine the capacity of the propane container

Step 2

Determine the location of the propane container system



APPENDIX 6

Suggested References for Environmental Emergencies Prevention, Preparedness and Response Measures, and the Development of E2 Plans

Emergency Management

1. British Columbia Ministry of Environment. BC Guidelines for the Industry Emergency Response Plans, July 2002

2. Canadian Standards Association (CSA). *Emergency Preparedness and Response: A National Standard of Canada* (CAN/CSA-Z731-03 (R2014). Toronto: CSA, 2003. This document can be ordered from CSA International at 1-800-463-6727 or from the CSA website at https://store.csagroup.org/

3. Canadian Standards Association (CSA). *Emergency Preparedness and Response for Petroleum and Natural Gas Systems* (CAN/CSA-Z246.2-18). Toronto: CSA, 2018. This document can be ordered from CSA International at 1-800-463-6727 or from the CSA website at https://store.csagroup.org/

4. Canadian Standards Association (CSA). *Emergency and Continuity Management Program* (CAN/CSA-Z1600-14). Toronto: CSA, 2018. This document can be ordered from CSA International at 1-800-463-6727 or from the CSA website at https://store.csagroup.org/

5. Chemical Accident Prevention, Preparedness and Response website at https://www.oecd.org/env/ehs/chemical-accidents/Guiding-principles-chemical-accident.pdf

6. National Fire Protection Association (NFPA). *NFPA 1600: Standard on Continuity, Emergency, and Crisis Management, 2019 Edition*. Quincy, Massachusetts: NFPA, 2007. This document can be ordered from the NFPA at 1-800-344-3555 or from the NFPA website at https://catalog.nfpa.org/Codes-and-Standards-C3322.aspx?icid=D661

7. Nova Scotia Environment. Contingency Planning Guidelines, May 2016

8. Organization for Economic Co-operation and Development (OECD). *OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Public Authorities, Industry (including Management and Labour), Communities and Other Stakeholders.* Paris: OECD, 2003. Available through the OECD Chemical Accident Prevention, Preparedness and Response website at https://www.oecd.org/env/ehs/chemical-accidents/Guiding-principles-chemical-accident.pdf

9. United Nations Environment Programme (UNEP). *APELL, Awareness and Preparedness for Emergencies at a Local Level: A process for improving community awareness and preparedness for technological*

hazards and environmental emergencies. Paris: UNEP, 2nd Edition 2015. This document can be downloaded from http://apell.eecentre.org/Modules/GroupDetails/UploadFile/APELL_Handbook_2016_-_Publication.pdf

Environmental Impact/Risk Assessment

10. *Center for Chemical Process Safety (CCPS), Chemical Hazard Engineering* Fundamentals, Version 2.0, 2019, CCPS 2019. This document can be downloaded from https://www.aiche.org/sites/default/files/docs/book-pages/chef_manual_v2.0.pdf

11. Chemical and Downstream Oil Industries Forum Guideline on Environmental Risk Tolerability for COMAH Establishments. https://www.sepa.org.uk/media/219154/cdoif_guideline__environmental_risk_assessment_v2.pdf

12. Guide to predicting environmental recovery durations from major accidents. Supporting guide to the Environmental risk tolerability for COMAH establishments guideline https://publishing.energyinst.org/topics/environment/guide-to-predicting-environmental-recovery-durations-from-major-accidents.-supporting-guide-to-the-environmental-risk-tolerability-for-comah-establishments-guideline

13. Lessons Learned from Practical Implementation of CDOIF Environmental Risk Tolerability Guideline for COMAH Establishments Fiona Parsons, Environmental Consultant, ABB Ltd, Daresbury Park, Warrington. https://www.icheme.org/media/8568/xxv-poster-08.pdf

14. National Oceanic and Atmospheric Administration NOAA's Chemical Aquatic Fate and Effects (CAFE) database

15. Organization for Economic Co-operation and Development (OECD). eChemPortal provides free public access to information on properties of chemicals including physical properties, toxicity, ecotoxicity, and environmental fate and behaviour. https://www.echemportal.org/echemportal/

16. [SETAC] Society of Environmental Toxicology and Chemistry. 2018. Technical Issue Paper: Environmental Risk Assessment of Chemicals. Pensacola (FL): SETAC. 5 pp https://cdn.ymaws.com/www.setac.org/resource/resmgr/publications_and_resources/ERA_TIP_Final.pdf

17. [SETAC] Society of Environmental Toxicology and Chemistry. 2018. Technical Issue Paper: Weight-of-Evidence in Environmental Risk Assessment of Chemicals. Pensacola (FL): SETAC. 8 pp https://cdn.ymaws.com/www.setac.org/resource/resmgr/publications_and_resources/setac_tip_weight_of_evidence.pdf

18. USEPA database of chemicals: https://comptox.epa.gov/dashboard.

19. USEPA Storm Water Management Model (SWMM) is a free software used for planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems in urban areas. https://www.epa.gov/water-research/storm-water-management-model-swmm

20. USEPA Water Quality Analysis Simulation Program (WASP) is a free software program used to interpret and predict water quality responses to natural phenomena and manmade pollution for various pollution management decisions. https://www.epa.gov/ceam/water-quality-analysis-simulation-program-wasp.

21. The U.S. Geological Survey website provides a list of software used for all water resources applications, including general use, water quality and chemistry, groundwater, statistics and graphics, and modelling. https://www.usgs.gov/products/software/water

Process Safety / Risk Management

22. American Petroleum Institute (API). *Recommended Practice 750, Management of Process Hazards*. Washington, D.C.: API, 1990. This document is available from API in Washington, D.C. (at 202-682-8000 or at its website at www.api.org).

23. Canadian Standards Association (CSA). Process Safety Management (CAN/CSA-Z7670-17). Toronto: CSA, 2017. This document can be ordered from CSA International at 1-800-463-6727 or from the CSA website at https://store.csagroup.org/

24. Canadian Chemical Producers' Association. *Site Self-Assessment Tool*. Ottawa:, 1999. This document can be downloaded from https://www.cheminst.ca/communities/divisions/psm/psm-publications/

25. Canadian Society for Chemical Engineering (CSChE). *Guidelines for Site Risk Communication*, 3rd Edition 2012, Ottawa: CSChE 2012. This document can be downloaded from https://www.cheminst.ca/communities/divisions/psm/psm-

publications/

26. Center for Chemical Process Safety (CCPS), Chemical Hazard Engineering Fundamentals, Version 2.0, 2019, CCPS 2019. This document can be downloaded from https://www.aiche.org/sites/default/files/docs/book-pages/chef_manual_v2.0.pdf

27. Conseil pour la réduction des accidents industriels majeurs (CRAIM) / Major Industrial Accidents Reduction Council (MIARC). *Risk Management Guide for Major Technological Accidents*, 7th Edition, 2017, Montréal. This document is currently available in both English and French at www.craim.ca

28. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) – *Process Safety Management (PSM) standards*. All standards are available from OSHA at https://www.osha.gov/SLTC/processsafetymanagement/standards.html

29. U.S. Environmental Protection Agency (EPA). *Areal Locations of Hazardous Atmospheres (ALOHA).* This software, as well as associated documentation, is available from the EPA website at https://www.epa.gov/cameo/aloha-software

30. U.S. Environmental Protection Agency (EPA). *General Guidance on Risk Management Programs for Chemical Accident Prevention (40 CFR Part 68)* (EPA-555-B-04-001). Washington, D.C.: U.S. EPA, 2009. This document is available from the EPA website at https://www.epa.gov/rmp/guidance-facilities-risk-management-programs-rmp#general

31. U.S. Environmental Protection Agency (EPA). Risk Management Program Guidance for Offsite Consequence Analysis (40 CFR Part 68) (EPA-555-B-99-009). Washington, D.C.: U.S. EPA, 2009. This document is available from the EPA website at https://www.epa.gov/rmp/rmp-guidance-offsite-consequence-analysis

32. U.S. Environmental Protection Agency (U.S. EPA). *RMP*Comp™ Modelling Program for Risk Management Plans.* RMP*Comp™ is a free computer program that can be used to complete off-site consequence analyses for the substances that originate from the Environmental Protection Agency's Risk Management Program list. This software can be downloaded from https://www.epa.gov/rmp/rmpcomp

APPENDIX 7

Checklist to Prepare an E2 Plan

The following checklist contains a list of items that could be considered for the preparation of an E2 Plan. Its use is not mandatory. The items highlighted in green text and preceded by an asterisk (*) are suggestions or examples based on best practices, and are not part of the regulatory requirements. Detailed information on the preparation of an E2 Plan can be found in Section 5 of the Technical Guidelines. The E2 Plan must be reviewed at least once a year, and updated as necessary.

NOTE: Completion of the checklist does not ensure compliance with the E2 Regulations. The availability and quality of the measures described in the E2 Plan must be concretely able to be deployed in order to meet the objectives of the E2 Regulations. This material has been prepared for convenience of reference and accessibility and does not have an official character. For all purposes of interpreting and applying the E2 Regulations, users must consult the official version of the Environmental Emergency Regulations, 2019

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
4(1)(a) and 4(1)(b)	☐	Does the E2 Plan list all of the regulated substances that require a plan? (see Section 4 of the Technical Guidelines if unclear)
4(3)	☐	If the E2 Plan is based on an existing emergency response plan developed for another piece of legislation, has it been reviewed, and amended as necessary, to ensure that it meets the requirements of the E2 Regulations?
General	☐	*Does the first page of the E2 Plan contain a list of emergency contact information?
	☐	*Does the E2 Plan have a one or two page summary of key components that is available for distribution to, or the use of, first responders?
	☐	*Does the E2 Plan have a table of contents, which will assist in case of an emergency?
4(2)(a)		*Description of the properties and characteristics of the substance and the maximum expected quantity of the substance at the facility*
	☐	Is the maximum expected quantity of each E2 substance at the facility documented?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	Is the information describing the properties and the characteristics of the substances (e.g. pH, density, colour, vapour pressure, boiling point, solubility, explosive, flammability, toxicity, incompatibility, reactivity) complete?
	☐	Have incompatible substances, and/or substances that are reactive with fire suppression chemicals been identified?
4(2)(b)		*Description of the commercial, manufacturing, processing or other activity involving the substance that takes place at the facility*
	☐	Are the activities (e.g. stored, produced, manufactured, reacted, used as a refrigerant, etc.) involving each substance identified in the E2 Plan described?
	☐	*Is a process flow diagram available?
4(2)(c)		*Description of the facility and of the area surrounding the facility that may be affected by an environmental emergency referred to in paragraph (d).*
	☐	Are all of the buildings at the facility, their general location, and uses described?
	☐	Is there a description of the container systems, reactors, process piping, etc. containing the substances identified in the E2 Plan?
	☐	Have the receptors that could potentially be impacted by the environmental emergency scenario(s) in the E2 Plan been identified? This includes, but is not limited to: hospitals, schools, residential, commercial, or industrial buildings, highways, public transit infrastructure, parks, forests, wildlife habitats, water sources or water bodies?
	☐	Is there a listing, or complete description of the area surrounding the facility that might be impacted by environmental emergency scenarios identified in the E2 Plan? This must include any receptors.

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	*Is there a map or detailed plan of the area surrounding the facility that might be impacted by environmental emergency scenarios identified in the E2 Plan? This should include any receptors.
4(2)(d)		*An identification of any environmental emergency that could reasonably be expected to occur at the facility and that would likely cause harm to the environment or constitute a danger to human life or health, including the environmental emergency referred to in paragraph (e) and, if applicable, …more likely to occur than the environmental emergency referred to in paragraph (e) and that would have the longest impact distance outside the boundary of the facility*
	☐	Has the environmental emergency referred to in Section 4(2)(e) of the Regulations been identified for each substance in the E2 Plan? (This is known as the ***worst-case scenario*** as defined in the E2 technical guidance document.)
	☐	Have the environmental emergencies that can reasonably be expected to occur at the facility and that would likely cause harm to the environment or constitute a danger to human life or health been identified for each substance? (These are ***alternate scenarios*** as defined in the E2 technical guidance document.)
	☐	If outside hazards or domino effects were considered in the evaluation of the scenarios, have they been documented?
	☐	Have the impact distances of all of the scenarios identified in the E2 Plan been determined?
	☐	Has the alternate scenario with the longest impact distance outside the boundary of the facility been identified for each substance? If this scenario is more likely to occur than the worst-case scenario, it is considered the ***alternate worst-case scenario*** identified in paragraph 4(2)(f) of the Regulations
	☐	*When determining the impact zones of the scenarios, were the endpoints used for the calculations/consequence analysis documented?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	*Were any analytical methods used to identify scenarios documented? E.g., *What if*, *HAZOP, fault-tree*, etc.
	☐	*If a multidisciplinary team participated in identifying and evaluating risks, were the identities of the team members documented?
	☐	*If the impacts of the scenarios were modeled, was the software used to calculate impact distances (RMP Comp, ALOHA, PHAST, other) documented?
	☐	*Was the modeling criteria documented in the E2 Plan?
	☐	*Have any processes used to evaluate the risks presented by the scenarios been documented? (e.g. risk matrix)
	☐	*Have any accident investigation procedures been documented?
	☐	*Have procedures for investigating near misses been documented?
	☐	*Has a history of internal accidents been compiled and kept up to date?
4(2)(e)		*Identification of the harm to the environment or danger to human life or health that would likely result from an environmental emergency involving the release of the maximum quantity of a substance that could be contained in the container system that has the largest maximum capacity.* ***(referred to the worst-case scenario, as defined by the E2 Technical Guidance document)***
	☐	Has the harm to the environment or danger to human life or health that would likely result from the worst-case scenario for each substance in the E2 Plan been identified and documented? (This includes any potential impacts to receptors.)
	☐	*Does the E2 Plan contain a map that identifies the potentially impacted areas and their distances in relation to the facility? If so, does it have a legend and a scale?
	☐	*Are the locations of any receptors that may be affected clearly shown on the map?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
4(2)(f)		*Identification of the harm to the environment or danger to human life or health that would likely result from the environmental emergency…. that would have the longest impact distance outside the boundary of the facility* ***(referred to as the alternate worst-case scenario, as defined by the E2 Technical Guidance document)***
	☐	If an alternate worst-case scenario has been identified, has the harm to the environment or danger to human life or health that might result been documented? (This includes any potential impacts to receptors.)
	☐	*Does the E2 Plan contain a map that identifies the potentially impacted areas and their distances in relation to the facility? If so, does it have a legend and a scale?
	☐	*Are the locations of receptors that might be affected clearly shown on the map?
4(2)(g)		*Description of the measures to be taken to prevent and prepare for the environmental emergencies identified under paragraph (d) and the measures that will be taken to respond to and recover from such emergencies if they were to occur*
	☐	Does the E2 Plan contain a description of the measures in place ***to prevent*** the identified environmental emergency scenarios? (Items below are provided for guidance on what could be considered for this requirement)
	☐	If any passive mitigation measures were used in the analysis of the worst-case scenario, have they been documented?
	☐	If any active or passive mitigation measures were used in the analysis of the alternate scenarios, have they been documented?
	☐	*If incompatible substances have been identified, are there measures or procedures in place to keep them segregated?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	*If substances that are reactive with fire suppression chemicals have been identified, are there measures or procedures in place to alert first responders, and/or keep them isolated?
	☐	*Are any applicable standards and/or codes of practice used at the facility identified?
	☐	*If applicable, is there a description of any Process Safety Management System that is in place at the facility?
	☐	*If applicable, is there a description of any aspects of a Hazard Control Program in use at the facility?
	☐	*If applicable, is there a description of any Management of Change systems in place to manage risks related to design changes to equipment, procedures, and organization?
	☐	*Is there a description of all devices, systems, or actions designed to reduce the likelihood and severity of the scenarios identified in the E2 Plan? (examples are provided below)
		Safety *preventive* barriers (examples)
	☐	*Is there a fire protection system?
	☐	*Is it verified regularly?
	☐	*Is there a regular and/or preventative maintenance program in place?
	☐	*Do the maintenance programs reflect the manufacturers' recommendations?
	☐	*Are there detectors with alarms (i.e. high-level alarms)?
	☐	*Are there automatic valves and interlock systems?
	☐	*Are there emergency shutdown devices?
	☐	*If applicable, are tanks protected from collision?
	☐	*Are equipment and lines clearly identified (colour code / ID tags)?
	☐	*Others?
		Safety *protective* barriers (examples)
	☐	*Are flashlights or safety lighting available in the event of a loss of power?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	*Are there any safety walls?
	☐	*Are there any retention basins?
	☐	*Are there any sprinklers or a deluge system?
	☐	*Do regular safety drills take place?
	☐	*Are evacuation procedures in place?
	☐	*Is redundancy built into the system?
	☐	*Are barriers regularly inspected/verified?
	☐	*Others?
	☐	Does the E2 Plan contain a description of the measures in place ***to prepare for*** the identified environmental emergency scenarios? (Items below are provided for guidance on what could be considered for this requirement)
	☐	*If an Incident Management System is in place, has it been documented?
	☐	*Have the lines of authority and responsibilities of all key incident management personnel, including external responders, been identified?
	☐	*Has an organizational chart been included?
	☐	*Has the notification procedure for employees and any visitors to the facility been documented and shared as necessary?
	☐	*Have employees received training on the process?
	☐	*Is there a process to ensure that visitors are aware of what to do in the event of an emergency?
	☐	*Have maps showing evacuation routes from the facility been included?
	☐	*Have standard operating procedures for the various components contained in the E2 Plan been developed? E.g., use of safety equipment, dealing with hazardous substances, emergency shut down, communications, shelter in place, evacuation, etc...
	☐	*Have these procedures been communicated as required?
	☐	*Have any mutual aid agreements with other local facilities been documented?
	☐	*Others?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	Does the E2 Plan contain a description of the active mitigation measures in place ***to respond to*** the identified environmental emergency scenarios? (Items below are provided for guidance on what could be considered for this requirement)
	☐	*Does the E2 Plan contain a list of all first responders and d government agencies that must be notified of an emergency and their associated contact information?
	☐	*Has an internal emergency response team been identified and their contact information documented?
	☐	*If there is no internal team, is there an agreement with a third party, such as local authorities, to respond in hazmat situations?
	☐	*Have the third party's capabilities been evaluated?
	☐	*Is there a process in place to classify/triage any incidents?
	☐	*Are the personnel having on-scene authority to: evaluate the situation, assess the magnitude of the emergency, and activate the E2 Plan identified?
	☐	*Is the response path clearly explained, including the establishment of an emergency operations centre, and ongoing assessment of the scene and notification to required parties?
	☐	*Is there a description/explanation as to how or when various standard emergency response procedures will be activated?
	☐	*Is there a response diagram (i.e., flowchart, decision tracker, etc.)?
	☐	*Is the emergency response equipment readily available?
	☐	*If there is a leak, can the response team access the emergency response equipment given any scenario studied?
	☐	*Have personnel responsible for managing security and site access during an emergency been identified?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	*Are there procedures in place to identify and account for personnel engaged in response activities?
	☐	*Others?
	☐	Does the E2 Plan contain a description of the measures in place ***to recover from*** the identified environmental emergency scenarios? (Items below are provided for guidance on what could be considered for this requirement)
	☐	*Is there a procedure in place to conduct a review and debrief on the emergency response procedures/resources activated during the response?
	☐	*Is there procedure in place for investigating an incident to identify the root cause or initiating event?
	☐	*Is there a process in place to ensure that the responsible person is briefed and the E2 Plan updated as required after an incident?
	☐	*Have waste management procedures or plans been developed to deal with the potential outcome of all of the scenarios identified in the E2 Plan?
	☐	*Have site restoration procedures or plans been developed to deal with the potential outcome of all of the scenarios identified in the E2 Plan?
	☐	*Does the company have the necessary resources?
	☐	*If not, has it made provisions with a partner?
	☐	*Have the partner's qualifications and abilities been assessed?
	☐	*Are the planned measures suited to the location?
	☐	*Are the planned measures appropriate with regard to the potential consequences?
	☐	*Others?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
4(2)(h)		*A list of the position titles of the persons who will make decisions and take a leadership role in the event of an environmental emergency and a description of their roles and responsibilities*
	☐	Is there a list of the position titles of the lead and decision-making personnel responsible for the implementation of the E2 Plan in the event of an environmental emergency?
	☐	Is there a clear and complete description of their roles and responsibilities?
	☐	*Have the people on the list been advised of their roles and responsibilities in the event of an environmental emergency?
	☐	*Is an organizational chart available?
4(2)(i)		*List of the environmental emergency training that has been or will be provided to prepare personnel at the facility who will respond in the event that an environmental emergency identified under paragraph (d) occurs*
	☐	Is there a list of the environmental emergency training that has been or will be provided to prepare personnel at the facility who respond to environmental emergencies?
	☐	*Have the training requirements for personnel involved in decision-making/leadership roles been identified and documented?
	☐	*Have the training requirements for response personnel at the facility been identified and documented?
	☐	*Does the identified training provide the personnel with all of the skills necessary to be successful in their identified roles and responsibilities?
	☐	*Have the completion and/or scheduled dates for each training course been documented for all required personnel?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	*Are there procedures in place to identify situations where updates to the training curriculum might be required, such as changes to equipment, processes, procedures, materials, duties, and/or new staff?
	☐	*Has training on personal protective equipment been given?
	☐	*Does it cover use and maintenance?
	☐	*Has training on the detection equipment been given?
	☐	*If training was provided on the use of detection equipment, did it cover its use, interpretation of results, maintenance, and calibration?
	☐	*Has training on hazardous materials (WHMIS) been given?
	☐	*Has the effectiveness of the training curriculum been evaluated through exercise simulations?
4(2)(j)		*A list of the emergency response equipment that is necessary for the measures described in paragraph (g) and the equipment's location*
	☐	Has a list of the emergency response equipment necessary to deal with all of the scenarios identified in the E2 Plan been documented?
	☐	Is the list of equipment complete and specific to the scenarios for which they may be deployed?
	☐	Is the location of the equipment indicated?
	☐	*Is there a map or plan available that identifies the locations of the response equipment and/or caches of response equipment?
	☐	*Is the condition of the equipment regularly calibrated and/or evaluated by qualified personnel?
	☐	*If there are regular and/or preventive maintenance programs in place, do they respect the manufacturers' recommendations?
	☐	*Is there a schedule in place for battery replacements and/or inspection of response equipment (e.g., fire extinguishers)?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
4(2)(k)		*A description of the measures that will be taken by a responsible person or by a responsible person and local authorities, acting jointly, to communicate with the members of the public who may be adversely affected by the environmental emergency referred to in paragraph (f) to inform them, **before** the environmental emergency occurs, of….*
	☐	Has the facility identified the alternate worst-case scenario for each substance identified in the E2 Plan? If not, the following three sections (4(2)(k)(i) to 4(2)(k)(iii)) do not apply to that substance. Skip to section 4(2)(l) in this table.
	☐	Have the measures that will be taken to provide advance communication with the members of the public who may be affected by the alternate worst-case scenario for each substance been identified? (e.g., participation in a joint coordinating committee, information session, posters, information bulletin, mail-outs, online, etc.)?
	☐	*Does the description of the measures indicate who is responsible for providing the advance notice, i.e., the facility or a third party?
	☐	*Does the description of the measures identify whether or not the local authorities (e.g., firefighters, police, municipality, etc...) will be involved? If so, are they identified?
	☐	*Do the measures contain references to the where the public can request additional information?
	☐	*Does the facility participate in a local emergency preparedness or response committee or any public safety committees and group that include municipal, industry and government representatives, and citizens?
	☐	*Have the measures been evaluated based on community feedback or simulation exercises?
	☐	*If applicable, has the E2 Plan been updated to in response to this feedback?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
(k)(i)		*The possibility that the environmental emergency could occur*
	☐	Do the communication measures identify the E2 substance(s) and scenario(s) for which the advance public notification will occur? (i.e., those involved in an alternate worst-case scenario)
(k)(ii)		*The potential effects of the environmental emergency on the environment and on human life or health, taking into account the factors referred to in paragraphs (a) to (c)*
	☐	Do the communication measures describe the potential effects of the alternate worst-case scenario(s) identified in the E2 Plan on the environment, and human life or health?
	☐	For each substance, when determining the potential effects of the alternate worst-case scenario(s) was consideration given to:
	☐	• The properties and characteristics of the substance?
	☐	• The maximum expected quantity of the substance at the facility?
	☐	• The activity(ies) involving the substance at the facility?
	☐	• Potential receptors in the area surrounding the facility?
(k)(iii)		*The measures that will be taken by the responsible person to protect the environment and human life or health, and the means by which the responsible person will communicate with them, in the event that the environmental emergency occurs*
	☐	Do the communication measures identify the actions that will be taken to protect the environment and human life or health in the event that the alternate worst-case scenario(s) occur(s)? This may include:
	☐	• Measures to be used to contain the substance and limit offsite migration

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	• Response measures to mitigate potential harm, and the involvement of any safety authorities or external contractors
	☐	• Measures to protect the public, such as the possibility of shelter in place orders or evacuation procedures
	☐	Do the communication measures describe early warning systems, alarms, and/or other means by which the affected public will be informed that the environmental emergency has started or is imminent?
	☐	Do the communication measures identify the means by which the facility will provide ongoing information as the environmental emergency unfolds?
	☐	Do the communication measures describe how the public will be notified that the environmental emergency has ended, and if applicable, when it is safe to return to their premises or stop sheltering in place?
4(2)(l)		*The measures that will be taken by a responsible person or by a responsible person and local authorities, acting jointly to…. communicate with the members of the public who may be adversely affected to provide them,* ***during*** *and* ***after*** *its occurrence, with information and guidance concerning the actions that could be taken … to reduce the potential harm to the environment and danger to human life or health, including an explanation of how those actions may help to reduce the harm or danger.*
	☐	Is there a description of the way in which potentially adversely affected members of the public will be communicated with during ***any*** scenario identified in the E2 Plan?
	☐	Does the description indicate whether the local authorities will be involved in any communications?
	☐	Does the description stipulate that the public will be informed of actions being taken to reduce the potential harm to the environment and danger to human life or health?

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
	☐	Does the description stipulate that the communications must explain how the actions being taken will reduce harm and/or danger?
	☐	Does the description indicate how members of the public will be notified that the environmental emergency has ended, and if applicable, when it is safe to return to their premises or stop sheltering in place?
	☐	Have the measures to be taken to communicate with the public AFTER the environmental emergency has occurred (e.g. press conference, news release, public meeting, evaluation presentations, social media) been described?
	☐	Does the description indicate that the communications will include an explanation of the measures to be undertaken to mitigate any remaining harm/danger resulting from the emergency?
4(2)(m)		*The position title of the individual who will communicate with the members of the public referred to in paragraphs (k) and (l)*
	☐	Is the position title(s) of individual(s) who will communicate with the members of the public provided in the E2 Plan?
	☐	Are there procedures in place to ensure that this information is updated as necessary?
4(2)(n)		*A description of the consultations that a responsible person had with local authorities, if any, with respect to the measures referred to in paragraphs (k) and (l)*
	☐	Does the E2 Plan describe any consultations with local authorities with respect to public communications before, during, and/or after an environmental emergency has occurred?
4(2)(o)		*A plan of the facility showing the location of any substances in relation to the physical features of the facility*
	☐	Does the E2 Plan contain a map/diagram of the facility that identifies the location of the onsite installations and the location of any E2substances

Checklist for the Preparation of an E2 Plan		
Subsection or paragraph of the Regulations		**Items to Include in the E2 Plan** **(Note: Items in green are suggestions, not requirements)**
		identified in the E2 Plan?
	☐	*Does the map/diagram indicate the relative distances between the location(s) of the substances and other physical features of the facility, including property borders?

APPENDIX 8

Suggested Table of Contents for an E2 Plan

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- Internal Public Relations Officer/Communication Officer contact List
- Resources Agencies contact list
- Government agencies contact list
- Public Safety Authority contact list
- Community residents contact list
- Waste Disposal Companies contact lists
- Response Organizations/Response contractors/Cleanup contractors contact lists
- E2 Plan distribution list
- Weather information contacts

Documentation:

- Substance list
- Incident Management Team/Incident Command Organizational Charts
- Emergency Incident Report forms
- Monitoring procedures (air emissions, land, water quality)
- Applicable Legislations (i.e. E2 Regulations, etc.)
- Decontamination procedures
- Safety Data Sheets
- Reference Publications

Dynamic Records

- Training Records
- Exercise Records
- Equipment inspection, testing and maintenance schedules
- Emergency equipment list (both on-site and off-site) & shelf-life

Maps/Diagrams

- Emergency evacuation plan and escape routes
- Shelter-in-Place Procedures
- Facility maps, Process diagrams, P&ID drawings
- Charts

APPENDIX 9

Suggested Endpoints for the E2 Regulations

1.0 Glossary

ADAM: Accident Damage Analysis Module – software developed in Europe for estimating impact distances for explosions, inhalation toxics and heat radiation impact distances.

AEGL-2 (1 hour): Acute Exposure Guideline Levels – the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

ERPG-2 (1 hour): Emergency Response Planning Guidelines – the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective action.

TEEL-2 (1 hour): Temporary Emergency Exposure Limits - the airborne concentration (expressed as ppm or mg/m3) of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

IDLH (30 minutes): Immediately Dangerous to Life and Health – the maximum airborne concentration from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects.

2.0 Introduction

This appendix deals with suggested endpoints for inhalation, heat radiation overpressure (explosion) effects, and flammable vapour concentration that could be used within an E2 Plan. The summarized endpoints are listed below:

- Inhalation endpoint: suggested endpoint would be the use of AEGL-02 (1 hour), where applicable.
- Heat radiation endpoint: suggested endpoint would be 5 kW/m^2.
- Overpressure endpoint: suggested endpoint would be 6.89 kPa (1 psi).
- Flammable vapour concentration endpoints: suggested endpoint would be % flammable limits in air.

Specific endpoints to model or analyze the impact from substances identified as aquatically toxic have not been included. References on how a facility might go about performing an assessment of the impacts of substances characterized as being aquatically toxic can be found in section 2.5 of this appendix.

2.1 Overpressure (explosion)

A vapour cloud explosion could yield a blast wave overpressure of 20.68 kPa (3.0 psi) at a distance of 100 metres from the blast site and could have potentially lethal effects in the community beyond the fence line. Lower overpressure levels could also potentially lead to serious or fatal injuries from indirect effects such as injury from flying glass or other debris in some cases. However, for lower pressures, the likelihood of a fatality is lower because there would be less damage to buildings and flying objects would have less force. **Typically, an E2 plan would model or analyze an endpoint of 6.89 kPa (1 psi)**. The table below describes estimated damages caused by overpressure.

Table 6: Overpressure Effects

Pressure		Effects on Structure	Effects on People
Psi	kPa		
0.3	2.07	• Safe distance • Damage limited to ceilings of houses • 10% window breakage	Thresholds of effects delineating the area of indirect effects by window breakage on people
1.0	6.9	• Partial demolition of houses rendering them uninhabitable • 90% of windows broken • Threshold of minor structural damage	Thresholds of irreversible effects delineating the “significant hazards to human life area”
2.0	13.8	• Partial collapse of house ceilings and walls; possible damage to large hydrocarbon tanks	Threshold of lethal effects delineating the “severe hazards to human life area”
3.0	20.7	• Steel structures of buildings are damaged and torn from their foundations • “Significant damage” threshold for glass domino effect threshold in which the effects must be analyzed	Significant effects threshold delineating the “very severe hazards to human life area”
4.4	30	• Threshold of very severe damage to structures	-
7.0	48.2	• Loaded transportation containers are overturned	-

CRAIM, Risk Management Guide for Major Industrial Accidents, Intended for Municipalities and Industry, p. 59, 2007.

2.2 Heat radiation

The flame from a fire can expose one to different levels of heat radiation. **Typically, an E2 plan would model or analyze an endpoint of 5 kW/m^2**. There is a suggested equation to estimate the lethality base for humans exposed to heat radiation. The probit (Pr) equation comes from the software referred to as ADAM and is based on animal data.

Equation 1

$\Pr = -13.65 + 2.56 \times LN[C^{1.333333} \times t]$

Where:

C = $\frac{kW}{m^2}$

t = seconds

After calculating Pr, one can then enter this code into Microsoft Excel to estimate the percent human lethality = (NORMSDIST(Pr-5))*100.

This equation has been used to generate tables that may be of use for understanding exposure times and percent lethality in humans.

Table 7: Constant Time (sec) vs Increasing Heat Radiation and its Estimated Human Lethality

Time (seconds)	Concentration (kW/m^2)	% Lethality
4	5.00	0.00
4	10.00	0.00
4	15.00	0.00
4	20.00	0.00
4	25.00	0.00
4	30.00	0.02
4	35.00	0.15
4	40.00	0.60
4	45.00	1.75
4	50.00	4.02
4	55.00	7.74
4	60.00	13.01
4	65.00	19.70
4	70.00	27.44
4	75.00	35.79
4	80.00	44.28
4	85.00	52.52

Table 8: Constant Heat Radiation (kW/m2) vs Increasing Time (sec) and its Estimated Human Lethality

Concentration (kW/m2)	Time (seconds)	% Lethality
5.00	10	0.00
5.00	20	0.00
5.00	30	0.00
5.00	40	0.01
5.00	50	0.08
5.00	60	0.37
5.00	70	1.13
5.00	80	2.63
5.00	90	5.08
5.00	100	8.58
5.00	110	13.07
5.00	120	18.39
5.00	130	24.34
5.00	140	30.65
5.00	150	37.10
5.00	160	43.49
5.00	170	49.65

The table below describes the effects of heat radiation upon structures and humans.

Table 9: Effects of Heat Radiation

Radiation (kW/m^2)	Effects on Structure	Effects on People
1.2	-	Received from the sun at noon in summer[2]
1.6	-	Will not cause discomfort even after a long exposure period[1]
2	-	Minimum to cause pain after 1 minute[2]
3	-	Irreversible effects threshold delineating the “significant hazards to human life area”[1]
4	-	Sufficient to cause pain to employees unable to take cover within 20 seconds.

Radiation (kW/m^2)	Effects on Structure	Effects on People
		However, skin blistering is possible (2nd degree burns) [1] 0% mortality[1]
Less than 5	-	Will cause pain in 15–20 seconds after injury after 30-second exposure[2]
5	Significant destruction of glass threshold[1]	Second degree burns after 20 seconds[1] Lethal effects threshold delineating the "severe hazards to human life area"[1]
Greater than 6	-	Pain within approximately 10 seconds; only rapid escape is possible[2]
8	Domino effects threshold corresponding to the severe damage to structures threshold[1]	Lethal effects hazard delineating the "very severe hazards to human life area"[1]
9.5	-	Pain threshold reached after 8 seconds[1] Second degree burns after 20 seconds[1]
12.5	Minimal energy required to ignite wood in the presence of an open flame and melt plastic tubing[1] *Thin steel with insulation on the side away from the fire may reach thermal stress level high enough to cause structural failure[2]	Significant chance of fatality for medium duration exposure[2]
25	Spontaneous ignition of wood after long exposure[2] Unprotected steel will reach thermal stress temperatures that can cause failure[2]	Likely fatality for extended exposure and significant chance of fatality for instantaneous exposure[2]
35	Cellulosic material will pilot ignite within one minute's exposure[2]	Significant chance of fatality for people exposed instantaneously[2]

1 CRAIM, Risk Management Guide for Major Industrial Accidents, Intended for Municipalities and Industry, p. 58, 2007.

2 HSE, Methods of Approximation and Determination of Human Vulnerability for Offshore Major Accident Hazard Assessment, p. 17, 2017.

2.3 Flammable vapour concentration

The flammable vapour concentration refers to the concentration range of a gas or vapor that will burn (or explode) if an ignition source is introduced and a source of oxygen is present. At concentrations below the lower limit, a substance is too lean to burn. At concentrations above the upper limit, a substance is too rich to burn. The table below identifies the flammable range for a number of E2 substances.

Table 10. Percent Flammable Limits in Air

Substance Name, CAS # and Hazard Class	Percent Flammable Limits in Air (%)	References
1,1-Difluoroethane CAS #: 75-37-6 (E)	3.7 to 18	CHEMINFO, 2007; CHRIS, 2007; HSDB, 2007; Genium, 2003
1,1-Difluoroethylene CAS #: 75-38-7 (E)	5.5 to 21.3	NIOSH
1,3-Butadiene CAS #: 106-99-0 (E)	2 to 11.5	CHEMINFO, HSDB
1,3-Butadiene, 2-methyl- CAS #: 78-79-5 (E)	1.5 to 8.9	HSDB, 2007; Genium, 2006; Pohanish, 2002
1,3-Pentadiene CAS #: 504-60-9 (E)	2 to 8.3	Cheminfo, Chris, Genium, NFPA
1-Buten-3-yne CAS #: 689-97-4 (E)	2 to 100	HSDB
1-Butene CAS #: 106-98-9 (E)	1.6 to 10	CHEMINFO, NFPA
1-Chloropropene CAS #: 590-21-6 (E)	4.5 to 16	HSDB
1-Pentene CAS #: 109-67-1 (E)	1.5 to 8.7	NFPA, Lewis
2,2-Dimethylpropane CAS #: 463-82-1 (E)	1.4 to 7.5	Patty's Toxicology, CHEMINFO
2-Butene CAS #: 107-01-7 (E)	1.8 to 9.7	Genium
2-Butene, (*E*)- CAS #: 624-64-6 (E)	1.8 to 9.7	HSDB, CHEMINFO, Genium
2-Butene, (*Z*)- CAS #: 590-18-1 (E)	1.7 to 9.0	HSDB, CHEMINFO, Lewis
2-Chloropropane CAS #: 75-29-6 (E)	2.8 to 10.7	CHEMINFO, HSDB
2-Chloropropene CAS #: 557-98-2 (E)	2.1 (LEL)	Genium
2-Methyl-1-butene CAS #: 563-46-2 (E)	1.4 to 10	CHEMINFO
2-Methylbutane CAS #: 78-78-4 (E)	1.4 to 7.6	CHEMINFO, HSDB, Genium
2-Methylpropene CAS #: 115-11-7 (E)	1.8 to 9.6	CHEMINFO, CHRIS, HSDB
2-Pentene, (*E*)- CAS #: 646-04-8 (E)	1.4 to 10	CHEMINFO
2-Pentene, (*Z*)- CAS #: 627-20-3 (E)	1.4 to 11	CHEMINFO
3-Methyl-1-butene CAS #: 563-45-1 (E)	1.5 to 9.1	Genium, CHEMINFO

Substance Name, CAS # and Hazard Class	Percent Flammable Limits in Air (%)	References
Acetaldehyde CAS #: 75-07-0 (E)	4 to 60	Genium, CHRIS, CHEMINFO, HSDB, NFPA
Acetylene CAS #: 74-86-2 (E)	2.5 to 100	HSDB, CHEMINFO, CHRIS
Benzene CAS #: 71-43-2 (C)	1.2 to 7.8	CHEMINFO, NIOSH
Bromotrifluoroethylene CAS #: 598-73-2 (E)	Not found	
Butane CAS #: 106-97-8 (E)	1.9 to 8.5	HSDB, Lewis, NFPA
Butene CAS #: 25167-67-3 (E)	1.6 to 10	CHEMINFO, HSDB
Carbonyl sulfide CAS #: 463-58-1 (E)	12 to 28.5	Genium, HSDB
Cyanogen CAS #: 460-19-5 (E)	6.6 to 32	NFPA, HSDB, NIOSH
Cyclohexane CAS #: 110-82-7 (C)	1.3 to 8.4	HSDB, Lewis
Cyclopropane CAS #: 75-19-4 (E)	2.4 to 10.3	Genium, HSDB, CHRIS, Cheminfo
Dichlorine oxide CAS #: 7791-21-1 (E)	23.6 to 100	HSDB
Dichlorosilane CAS #: 4109-96-0 (E)	4.7 to 96	Genium
Dimethyl ether CAS #: 115-10-6 (E)	3.4 to 27	CHEMINFO, HSDB, Lewis, NFPA
Dimethyl sulfide CAS #: 75-18-3 (C)	2.2 to 19.7	CHEMINFO, CHRIS
Dimethylamine CAS #: 124-40-3 (E)	2.8 to 14.4	CHEMINFO, HSDB, NFPA
Ethane CAS #: 74-84-0 (E)	3 to 12.5	CHEMINFO, Lewis, NFPA
Ethyl chloride CAS #: 75-00-3 (E)	3.8 to 15.4	CHEMINFO, HSDB, NFPA
Ethyl ether CAS #: 60-29-7 (E)	1.9 to 36	NIOSH, HSDB, NFPA
Ethyl mercaptan CAS #: 75-08-1 (E)	2.8 to 18	HSDB, CHEMINFO, Genium
Ethyl nitrite CAS #: 109-95-5 (E)	4 to 50	HSDB, CHRIS
Ethylacetylene CAS #: 107-00-6 (E)	2.02 to 32.9	Praxair Canada Inc., 2001
Ethylamine CAS #: 75-04-7 (E)	3.5 to 14	Genium, HSDB, CHEMINFO
Ethylbenzene CAS #: 100-41-4 (C)	0.8 to 6.7	HSDB, CHEMINFO
Ethylene CAS #: 74-85-1 (E)	2.7 to 36	HSDB, CHEMINFO, NFPA

Substance Name, CAS # and Hazard Class	Percent Flammable Limits in Air (%)	References
Gasoline (motor fuel) CAS #: 86290-81-5 (C)	1.4 to 7.6	NIOSH, NFPA
Hydrogen CAS #: 1333-74-0 (E)	4 to 75	Genium
Isobutane CAS #: 75-28-5 (E)	1.8 to 8.4	Genium, CHEMINFO, HSDB
Isopropylamine CAS #: 75-31-0 (E)	2 to 10.4	CHEMINFO, HSDB, NFPA
Liquefied natural gas CAS #: 8006-14-2 (E)	5 - 15	LNG Transport, 2012
Methane CAS #: 74-82-8 (E)	5 to 15	NFPA, HSDB, CHRIS
Methyl formate CAS #: 107-31-3 (E)	5 to 23	NIOSH, CHEMINFO
Methylacetylene CAS #: 74-99-7 (E)	1.7 to 11.7	Genium, HSDB, CHEMINFO
Methylamine CAS #: 74-89-5 (E)	4.9 to 20.7	HSDB, CHEMINFO
Naphtha CAS #: 8030-30-6 (C)	1.1 to 5.9	Genium, HSDB
Naphtha, petroleum, full-range alkylate, butane-containing CAS #: 68527-27-5 (C)		
Naphtha, petroleum, sweetened CAS #: 64741-87-3 (E)		
Natural gas condensates CAS #: 68919-39-1 (C)	1 to 13	Marathon, Devon
Natural gas condensates, petroleum CAS #: 64741-47-5 (C)	1.05 to 7.8 1 to 10 (est.) 1 to 6.5 (Octane)	TRICAN Gibson KEYERA
Natural gas, petroleum, raw liquid mix CAS #: 64741-48-6 (E)	1.4 to 13	ONEOK
Pentane CAS #: 109-66-0 (E)	1.5 to 7.8	CHEMINFO, HSDB, Genium
Propadiene CAS #: 463-49-0 (E)	2.1	Pohanish, 2002a
Propane CAS #: 74-98-6 (E)	2.1 to 9.5	NIOSH, CHEMINFO, CHRIS
Propylene CAS #: 115-07-1 (E)	2 to 11	CHRIS, NOVA
Silane CAS #: 7803-62-5 (E)	1.4 to 96	Genium
Styrene CAS #: 100-42-5 (E)	0.9 to 6.8	NIOSH, CHEMINFO
tert-Butylamine *CAS #:* 75-64-9 (C)	1.7 to 8.9	CHEMINFO, Genium
Tetrafluoroethylene CAS #: 116-14-3 (E)	10 to 50	NFPA, Genium
Tetramethylsilane CAS #: 75-76-3 (E)	1 to 38	CHEMINFO
Toluene CAS #: 108-88-3 (C)	1.1 to 7.1	CHEMINFO, NIOSH
Trichlorosilane CAS #: 10025-78-2 (E)	1.2 to 90.5	Genium, HSDB

Substance Name, CAS # and Hazard Class	Percent Flammable Limits in Air (%)	References
Trifluorochloroethylene CAS #: 79-38-9 (E)	8.4 to 38.7	CHEMINFO, Genium, NFPA
Trimethylamine CAS #: 75-50-3 (E)	2 to 11.6	CHEMINFO, HSDB, CHRIS
Unleaded gasoline CAS #: 8006-61-9 (C)	1.4 to 7.6	NIOSH, NFPA
Vinyl chloride CAS #: 75-01-4 (E)	3.6 to 33	ATSDR, Genium
Vinyl ethyl ether CAS #: 109-92-2 (E)	1.7 to 28	HSDB, CHRIS
Vinyl fluoride CAS #: 75-02-5 (E)	2.6 to 21.7	Genium, HSDB, NIOSH
Vinyl methyl ether CAS #: 107-25-5 (E)	2.6 to 39	CHRIS, HSDB
Vinylidene chloride CAS #: 75-35-4 (E)	6.5 to 15.5	CHEMINFO, HSDB
Xylenes CAS #: 1330-20-7 (C)	1 to 7	CESARS

2.4 Inhalation toxics

When an emergency occurs involving the release of toxic substances, there are some Public Exposure Guidelines that establish endpoints effect that will help industry predict how members of the general public would be affected. We suggest using one of the four most common endpoint values for modelling or calculating impact distances for E2 substances that are toxic by inhalation **in this specific order**: AEGL-2[2] (60-minute), ERPG-2 (60-minute), TEEL-2 (60-minute) and 1/10 of IDLH (30-minute). **AEGL-2 is recommended** to be used as a first choice endpoint since this concentration is designed to protect sensitive individuals such as old, sick, or very young people. The table below has been assembled from the Web as a convenient reference for inhalation toxic endpoints. The values indicated as (F) are final for AEGL, but other values may be subject to change over time.

Table 11: Potential endpoints for inhalation hazard substances included in the E2 Regulations

Item	CAS #	E2 Substance Name	AEGL-02[a]	ERPG-02[b]	TEEL-2[c]	IDLH[d] (1/10)
1	50-00-0	formaldehyde, solution	14 (I)	10	14	20 (2)
2	57-14-7	1,1-dimethylhydrazine	3.0 (F)	None	3	15 (1.5)
3	60-34-4	methylhydrazine	0.90 (F)	None	0.9	20 (10)

.

[2]AEGL values are developed for different exposure durations (10 min, 30 min, 60 min, 4 hours and 8 hours). ECCC recommends to choose the AEGL value with the exposure duration that is equal to or above the substance release time suggested in the scenario identified in the E2 plan. For example, if your scenario has a release time of 40 minutes then you have to choose AEGL-2 60 min. For a release time of 90 minutes, you will have to choose AEGL-2 4 hours.

Item	CAS #	E2 Substance Name	AEGL-02[a]	ERPG-02[b]	TEEL-2[c]	IDLH[d] (1/10)
4	64-19-7	acetic acid	None	35	35	50 (5)
5	67-66-3	chloroform	64 (F)	50	64	500 (50)
6	74-83-9	methyl bromide	210 (F)	50	210	250 (25)
7	74-87-3	methyl chloride	910 (F)	1000	910	2000 (200)
8	74-88-4	methyl iodide	82 (P)	50	50	100 (10)
9	74-90-8	hydrogen cyanide	7.1 (F)	10	7.1	50 (5)
10	74-90-8	hydrocyanic acid	7.1 (F)	None	7.1	None
11	74-93-1	methyl mercaptan	23 (F)	25	23	150 (15)
12	75-09-2	dichloromethane	560 (I)	750	560	2300 (230)
13	75-15-0	carbon disulphide	160 (F)	50	160	500 (50)
14	75-21-8	ethylene oxide	45 (F)	50	45	800 (80)
15	75-44-5	phosgene	0.30 (F)	0.5	0.3	2 (0.2)
16	75-55-8	propyleneimine	12 (F)	None	12	100 (10)
17	75-56-9	methyloxirane	290 (F)	250	290	400 (40)
18	75-74-1	tetramethyl lead	None	None	4 mg/m^3	40 mg (lead)/m^3 (4)
19	75-77-4	trimethylchlorosilane	22 (F)	20	22	None
20	75-78-5	dimethyldichlorosilane	11 (F)	10	11	None
21	75-79-6	methyltrichlorosilane	7.3 (F)	3	7.3	None
22	76-06-2	trichloronitromethane	0.15 (I)	0.15	0.15	2 (0.2)
23	78-00-2	tetraethyl lead	None	None	4 mg/m^3	40 mg (lead)/m^3 (4)
24	78-82-0	isobutyronitrile	2.0 (F)	30	2	None
25	79-21-0	Peracetic acid	1.6 mg/m^3 (F)	None	1.6 mg/m^3	None
26	79-22-1	methyl chloroformate	2.2 (F)	2	2.2	None
27	91-08-7	toluene-2,6-diisocyanate	0.083 (F)	0.15	0.083	None
28	106-89-8	oxirane (chloromethyl)-	24 (F)	20	24	75 (7.5)
29	107-02-8	acrolein	0.10 (F)	0.15	0.1	2 (0.2)
30	107-05-1	allyl chloride	54 (I)	40	54	250 (25)
31	107-06-2	1,2-dichloroethane	None	200	200	50 (5)
32	107-07-3	2-chloroethanol	1.2 (F)	None	1.2	7 (0.7)
33	107-11-9	allylamine	3.3 (F)	None	3.3	None
34	107-12-0	propionitrile	3.0 (F)	None	3	None
35	107-13-1	acrylonitrile	1.7 (F)	35	1.7	85 (8.5)

Item	CAS #	E2 Substance Name	AEGL-02[a]	ERPG-02[b]	TEEL-2[c]	IDLH[d] (1/10)
36	107-15-3	ethylenediamine	9.7 (F)	None	9.7	1000 (100)
37	107-18-6	allyl alcohol	1.7 (F)	None	1.7	20 (2)
38	107-30-2	chloromethyl methyl ether	0.47 (F)	1	0.47	None
39	108-05-4	vinyl acetate	36 (F)	75	36	None
40	108-23-6	isopropyl chloroformate	3.3 (F)	5	3.3	None
41	108-91-8	cyclohexylamine	8.6 (F)	None	8.6	None
42	108-95-2	phenol	23 (F)	50	23	250 (25)
43	109-61-5	propyl chloroformate	3.0 (F)	None	3.7	None
44	110-00-9	furan	6.8 (F)	None	6.8	None
45	110-89-4	piperidine	33 (F)	None	33	None
46	123-73-9	*trans*-crotonaldehyde	4.4 (F)	None	4.4	None
47	123-91-1	1,4-dioxane	320 (I)	None	320	500 (50)
48	126-98-7	methylacrylonitrile	1.0 (F)	None	1	4 (0.4)
49	151-56-4	ethyleneimine	4.6 (F)	None	4.6	100 (10)
50	302-01-2	hydrazine	13 (F)	5	13	50 (5)
51	353-42-4	boron trifluoride dimethyl etherate	None	None	29	None
52	463-51-4	ketene	0.063 (F)	None	0.063	5 (0.5)
53	506-68-3	cyanogen bromide	None	None	44	None
54	506-77-4	cyanogen chloride	None	0.05	0.05	None
55	509-14-8	tetranitromethane	0.52 (F)	None	0.52	4 (0.4)
56	542-88-1	bis(chloromethyl) ether	0.044 (F)	0.1	0.044	None
57	556-64-9	methyl thiocyanate	None	None	28	None
58	584-84-9	toluene-2,4-diisocyanate	0.083 (F)	0.15	0.083	2.5 (0.25)
59	594-42-3	perchloromethyl mercaptan	0.3 (F)	None	0.3	10 (1)
60	624-83-9	methyl isocyanate	0.067 (F)	0.25	0.067	3 (3)
61	630-08-0	carbon monoxide	83 (F)	350	83	1200 (120)
62	814-68-6	acryloyl chloride	None	None	0.24	None
63	1336-21-6	ammonium hydroxide	None	None	330	None
64	2551-62-4	sulphur hexafluoride	None	None	33000	None
65	4170-30-3	crotonaldehyde	4.4 (F)	5	4.4	50 (5)
66	7439-97-6	mercury	1.7 mg/m^3 (I)	0.25 (vapour)	1.7	10 mg (Hg)/ m^3 (1)
67	7446-09-5	sulphur dioxide	0.75 (F)	3	0.75	100 (10)

Item	CAS #	E2 Substance Name	AEGL-02[a]	ERPG-02[b]	TEEL-2[c]	IDLH[d] (1/10)
68	7446-11-9	sulphur trioxide	8.7 mg/m^3 (I)	10 mg/m^3	8.7	None
69	7550-45-0	titanium tetrachloride	1.0 (I)	20 mg/m^3	1	None
70	7616-94-6	perchloryl fluoride	4.0 (F)	None	4	100 (10)
71	7637-07-2	boron trifluoride	29 mg/m^3 (F)	30 mg/m^3	29	25 (2.5)
72	7647-01-0	hydrogen chloride, anhydrous	22 (F)	20	22	50 (5)
73	7647-01-0	hydrochloric acid	None	None	22	None
74	7664-39-3	hydrogen fluoride, anhydrous	24 (F)	20	24	30 (3)
75	7664-39-3	hydrofluoric acid	None	None	24	None
76	7664-41-7	ammonia, anhydrous	160 (F)	150	160	300 (30)
77	7664-41-7	ammonia solution	None	None	160	None
78	7697-37-2	Nitric acid	24 (F)	10	24	25 (2.5)
79	7719-09-7	thionyl chloride	2.4 (I)	2	2.4	None
80	7719-12-2	phosphorus trichloride	2.0 (F)	3	2	25 (2.5)
81	7723-14-0	phosphorus	11 mg/m^3 (P)	None	3	5 mg/m^3 (0.5)
82	7726-95-6	Bromine	0.24 (F)	0.5	0.24	3 (0.3)
83	7782-41-4	Fluorine	5.0 (F)	5	0.17	25 (2.5)
84	7782-50-5	chlorine	2.0 (F)	3	2	10 (1)
85	7783-06-4	hydrogen sulphide	27 (F)	30	27	100 (10)
86	7783-07-5	hydrogen selenide	0.11 (F)	0.2	0.11	1 (0.1)
87	7783-60-0	sulphur tetrafluoride	None	None	0.1	None
88	7784-34-1	arsenous trichloride	None	None	10	None
89	7784-42-1	arsine	0.17 (F)	0.5	0.17	3 (0.3)
90	7790-94-5	Chlorosulfuric acid	4.4 mg/m^3 (I)	10 mg/m^3	4.4 mg/m^3	None
91	7803-51-2	phosphine	2.0 (F)	0.5	2	50 (5)
92	7803-52-3	stibine	1.5 (I)	0.5	1.5	5 (0.5)
93	8014-95-7	sulphuric acid, fuming	8.7 mg/m^3 (I)	10 mg/m^3	8.7 mg/m^3	None
94	10025-87-3	phosphorus oxychloride	None	None	0.48	None
95	10035-10-6	hydrogen bromide	40 (F)	None	40	30 (0.3)
96	10035-10-6	hydrobromic acid	None	None	40	None
97	10049-04-4	chlorine dioxide	1.1 (F)	0.5	1.1	5 (5)

Item	CAS #	E2 Substance Name	AEGL-02[a]	ERPG-02[b]	TEEL-2[c]	IDLH[d] (1/10)
98	10102-43-9	nitric oxide	None	None	12	100 (10)
99	10102-44-0	nitrogen dioxide	12 (F)	15	12	20 (2)
100	10294-34-5	boron trichloride	29 mg/m^3 (F)	None	71	None
101	13463-39-3	nickel carbonyl	0.036 (F)	None	0.036	2 (0.2)
102	13463-40-6	iron pentacarbonyl	0.060 (F)	None	0.06	0.4 (0.04)
103	19287-45-7	diborane	1.0 (F)	1	1	15 (1.5)
104	20816-12-0	osmium tetroxide	0.0084 (I)	None	0.0084	1 mg (Os)/m^3 (0.1)
105	26471-62-5	toluene diisocyanate	None	None	0.083	None

[a] AEGL-02, Acute Exposure Guideline Levels, U.S. Environmental Protection Agency, 2017; (F) = final; (I) = interim; (P) = proposed; 60 minutes; ppm unless otherwise stated. https://www.epa.gov/aegl

[b] ERPG-02, Emergency Response Planning Guidelines, 2016; ppm unless otherwise stated. aiha.org

[c] TEEL-2, Temporary Emergency Exposure Limits, U.S Department of Energy, 2016; 60 minutes; ppm unless otherwise stated. https://www.energy.gov/

[d] IDLH, Immediately Dangerous to Life or Health, The National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 2019; ppm unless otherwise stated. https://www.cdc.gov/niosh/idlh/intridl4.html

2.5 Aquatically Toxic Substances

The impacts of the release of a substance that has aquatically toxic characteristics will vary based on the location of the area exposed. Site-specific factors that need to be taken into consideration when assessing the potential harm that could result from a release of an aquatically toxic substance include:

- Proximity to wells and/or drinking water sources;
- Proximity to water bodies and municipal infrastructure such as storm sewers and combined sewers;
- Local fish and benthic invertebrate communities, their habitat, and food sources;
- The presence of any endangered species, critical habitat, and species at risk;
- Nearby conservation areas or areas of natural and scientific interest;
- The flow rate of any impacted waterbodies;
- Seasonal variations in waterways;
- The potential for groundwater contamination; and
- Recreational uses of potentially impacted waterbodies

There are a wide variety of potential receptors, all of which likely have different sensitivities. The release of a substance into a creek that is located in a highly industrialized area will not have the same impact as its release into a pristine stream that is a spawning ground for salmon. In some locations, the potential for harm may even be seasonal (e.g., the release can only impact a stream that flows exclusively when spring water levels are high).

The characteristics of some substances can also change based on the pH of the water into which they are released, or when exposed to intense solar radiation. The newly formed products may have a different level of toxicity. As a result of all of these variables, specific endpoints to model or analyze the impact from substances identified as aquatically toxic have not been included in the Guidelines.

It is recommended that a facility assess the potential impacts of a release prior to deciding what endpoints would be most appropriate for their location. Any modelling or analysis conducted to determine the environmental emergencies that could cause harm should focus on the release of the substance and its potential pathways to a water body. The assessment and remediation of impacted water bodies may also be subject to requirements under the Fisheries Act and provincial/territorial legislation.

A list of information sources regarding the assessment and modelling of the environmental impacts of chemical substances is provided below. The list is not exhaustive and ECCC recommends that other references and tools that are available also be investigated (if necessary) to address any site specific requirements. Some of the modelling softwares also have very specific uses and will not be suitable for all purposes. Note that this list is provided for information purposes only and is not an endorsement of any product. It is incumbent on the responsible person to select the assessment tools most suited to determine the potential harm that could result from an environmental emergency at their facility

Environmental Impact/Risk Assessment

1. Center for Chemical Process Safety (CCPS), Chemical Hazard Engineering Fundamentals, Version 2.0, 2019, CCPS 2019. Environmental toxicity is discussed on pages 41-42. This document can be downloaded from https://www.aiche.org/sites/default/files/docs/book-pages/chef_manual_v2.0.pdf

2. Chemical and Downstream Oil Industries Forum Guideline on Environmental Risk Tolerability for COMAH Establishments. (COMAH refers to legislation in the United Kingdom regarding the control of major accident hazards.) https://www.sepa.org.uk/media/219154/cdoif_guideline__environmental_risk_assessment_v2.pdf

3. Guide to predicting environmental recovery durations from major accidents. Supporting guide to the Environmental risk tolerability for COMAH establishments

guideline https://publishing.energyinst.org/topics/environment/guide-to-predicting-environmental-recovery-durations-from-major-accidents.-supporting-guide-to-the-environmental-risk-tolerability-for-comah-establishments-guideline

4. Lessons Learned from Practical Implementation of CDOIF Environmental Risk Tolerability Guideline for COMAH Establishments Fiona Parsons, Environmental Consultant, ABB Ltd, Daresbury Park, Warrington, WA4 4BT https://www.icheme.org/media/8568/xxv-poster-08.pdf

5. National Oceanic and Atmospheric Administration NOAA's Chemical Aquatic Fate and Effects (CAFE) database allows anyone to determine the fate and toxicological effects of thousands of chemicals, oils, and dispersants when released into fresh or saltwater environments. CAFE has two major components: the Fate module, which predicts how a contaminant will behave in the environment, and the Effects module, which determines the chemical's potential toxicity to different species.

6. Organization for Economic Co-operation and Development (OECD). eChemPortal provides free public access to information on properties of chemicals including physical properties, toxicity, ecotoxicity, and environmental fate and behaviour. https://www.echemportal.org/echemportal/

7. [SETAC] Society of Environmental Toxicology and Chemistry. 2018. Technical Issue Paper: Environmental Risk Assessment of Chemicals. Pensacola (FL): SETAC. 5 pp https://cdn.ymaws.com/www.setac.org/resource/resmgr/publications_and_resources/ERA_TIP_Final.pdf

8. [SETAC] Society of Environmental Toxicology and Chemistry. 2018. Technical Issue Paper: Weight-of-Evidence in Environmental Risk Assessment of Chemicals. Pensacola (FL): SETAC. 8 pp https://cdn.ymaws.com/www.setac.org/resource/resmgr/publications_and_resources/setac_tip_weight_of_evidence.pdf

9. USEPA database of chemicals: https://comptox.epa.gov/dashboard. Includes information for a number of substances on:
    - Bioconcentration factor
    - Atmospheric hydroxylation rate
    - Biodegradeable half life
    - Fish biotrans metabolic biotransformation half life (kmkM)
    - Soil adsorption coefficient\Bio-accumulation factor

Modelling

1. CHEMMAP is a chemical discharge modeling and response system that predicts the transport, fate, and biological impacts of a wide variety of chemical substances in the

marine environment and atmosphere. https://www.rpsgroup.com/services/oceans-and-coastal/modelling/products/chemmap/

2. MIKE Powered by DHI have a number of software products are used within all water environments including oceans and coastlines, rivers and reservoirs, ecology, groundwater, water distribution, wastewater, etc. https://www.mikepoweredbydhi.com/

3. OILMAP is an oil spill model system suitable for use in oil spill response and contingency planning. https://www.rpsgroup.com/services/oceans-and-coastal/modelling/products/oilmap/

4. USEPA Storm Water Management Model (SWMM) is a free software program used for planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems in urban areas. https://www.epa.gov/water-research/storm-water-management-model-swmm

5. USEPA Water Quality Analysis Simulation Program (WASP) is a free software program used to interpret and predict water quality responses to natural phenomena and manmade pollution for various pollution management decisions. https://www.epa.gov/ceam/water-quality-analysis-simulation-program-wasp.

6. The U.S. Geological Survey website provides a list of software used for all water resources applications, including general use, water quality and chemistry, groundwater, statistics and graphics, and modelling. https://www.usgs.gov/products/software/water

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USEPA database of chemicals: https://comptox.epa.gov/dashboard

www.ec.gc.ca

Additional information can be obtained at:

Environment Canada
Inquiry Centre
10 Wellington Street, 23rd Floor
Gatineau QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-997-2800
Fax: 819-994-1412
TTY: 819-994-0736
Email: enviroinfo@ec.gc.ca